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CIRCULAR NO. 156

U. S. Naval Observatory, Washington, D. C. 20390 October 1, 1976

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SOLAR ECLIPSES OF 1977

Annular Solar Eclipse of 18 April 1977
Total Solar Eclipse of 12 October 1977

by

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SOLAR ECLIPSES 1977

GENERAL INFORMATION

The path of the annular phase of the solar eclipse of 18 April 1977 touches the earth at sunrise in the central South Atlantic Ocean at approximately 0843 UT. Traveling east northeast, the path crosses the west coast of Africa in central South-West Africa (Namibia) at approximately 0934 UT, where the duration is 6^m23^s, the width of path is 134 miles, and the altitude of the sun is 52°. The path arches gradually across the continent, passing over the southeastern tip of Angola, central Zambia, the southern extension of Zaire, the northern tip of Malawi and Lake Nyasa, and central Tanzania to the east coast at approximately 1116 UT, where the duration is 6^m46^s, the width of the path is 143 miles, and the altitude of the sun is 57°. The path crosses the southern half of Zanzibar Island one minute later and continues southeast into the Indian Ocean, passing over the Seychelles at approximately 1158 UT, the Egmont Islands and Diego Garcia at approximately 1215 UT, and the Salomon Islands at approximately 1216 UT. For the latter two groups the sun will set before fourth contact. The path leaves the earth at sunset in the central Indian Ocean at 1219 UT. Maximum duration of 6^m59^s and altitude of 66° is reached at approximately 1040 UT in northeastern Zambia. Central eclipse at local apparent noon occurs at approximately 1018 UT in central western Zambia.

Partial phases of the eclipse, of magnitude decreasing with the distance from the path of annular phase, will be visible over the eastern tip of South America, all of Africa except the extreme north and northwest, the Arabian peninsula, the Indian subcontinent, portions of Antarctica, the South Atlantic Ocean, and the western half of the Indian Ocean.

The path of the total phase of the solar eclipse of 12 October 1977 touches the earth at sunrise in the central North Pacific Ocean at approximately 1849 UT. Traveling southeast over open water almost to the equator south of Central America, the path then travels almost due east, crossing the coast of Colombia at approximately 2202 UT, and leaves the earth at sunset in southern Venezuela at approximately 2205 UT. At the coast, duration is 1^m05^s, the width of the path is 39 miles, and the altitude of the sun is 16°. At the end of the path, duration is 44^s, the width of the path is 29 miles, and the sun is setting. The sun will set before fourth contact for all portions of the path over land.

Partial phases of the eclipse, of magnitude decreasing with the distance from the path of total phase, will be visible over the eastern tip of Siberia, all of North America except the extreme northeast, Central America, northwestern South America, and the eastern half of the North Pacific Ocean, including Hawaii.

GENERAL INFORMATION *(Continued)*

The predictions in this *Circular* are derived from the basic data in the 1977 *American Ephemeris and Nautical Almanac.* The arguments are in Universal Time, and the longitudes east of Greenwich are negative. The solar ephemeris is referred to the same equinox as the lunar ephemeris by applying a provisional correction of $1^s.34$. The value of ΔT used in the computations is $46^s.36$ ($47^s.70 - 1^s.34$) for 18 April and $46^s.81$ ($48^s.15 - 1^s.34$) for 12 October.

The value of 0.2724880 for **k** has been used in these calculations except for the calculations of duration on the central line, where the value 0.272281 has been used by way of applying an approximate correction for the irregularities of the lunar limb. The duration tabulated in local circumstances is derived from the second and third contacts.

In the local circumstances, the angle P is the position angle of the point of contact, measured eastward from the north point of the solar limb, and the angle V is the position angle of the point of contact, measured eastward from the vertical circle.

In the calculation of local circumstances for geographic locations, the coordinates are taken from the *Times Atlas of the World,* 1967; the *American Ephemeris and Nautical Almanac*; National Ocean Survey (NOAA); or from the detail maps. The altitude is included for observatories, major U. S. cities, and cities shown on the detail maps. Otherwise it is assumed to be zero.

The detailed circumstances of the central phases were plotted by the Nautical Almanac Office on portions of the JNC Jet Navigation Charts of the Defense Mapping Agency Hydrographic Center. Final copy was prepared by Marie Lukac. The maps from the *American Ephemeris and Nautical Almanac* were originally prepared by Julena Duncombe.

Climatological data for Colombia was obtained from HIMAT, the Colombian Hydrological and Meteorological Service, and forwarded by Karl Simmons.

It is requested that precise observations of contact times of either eclipse and precise coordinates of the place of observation be reported to

The Nautical Almanac Office
U. S. Naval Observatory
Washington, D. C. 20390, U. S. A.

Annular Eclipse of the Sun, 18 April

ELEMENTS OF THE ECLIPSE

U. T. of geocentric conjunction in right ascension, April $18^d10^h17^m59^s.87$

	h m s		s s
R. A. of Sun and Moon	1 45 01.260	Hourly motions	9.299 and 118.152
	° ′ ″		′ ″
Declination of Sun	+10 51 26.13	Hourly motion	+ 0 52.31
Declination of Moon	+10 28 57.84	Hourly motion	+ 8 07.21
Equatorial hor. par. of Sun	8.76	True semidiameter of Sun	15 55.5
Equatorial hor. par. of Moon	54 28.10	True semidiameter of Moon	14 50.5

CIRCUMSTANCES OF THE ECLIPSE

		U. T.	Longitude	Latitude
		d h m	° ′	° ′
Eclipse begins	April	18 07 32.8	+17 08	−29 31
Central eclipse begins		18 08 43.1	+32 18	−38 05
Central eclipse at local apparent noon		18 10 18.0	−25 20	−13 40
Central eclipse ends		18 12 18.5	−83 36	− 8 18
Eclipse ends		18 13 28.8	−67 42	+ 0 21

Total Eclipse of the Sun, 12 October

ELEMENTS OF THE ECLIPSE

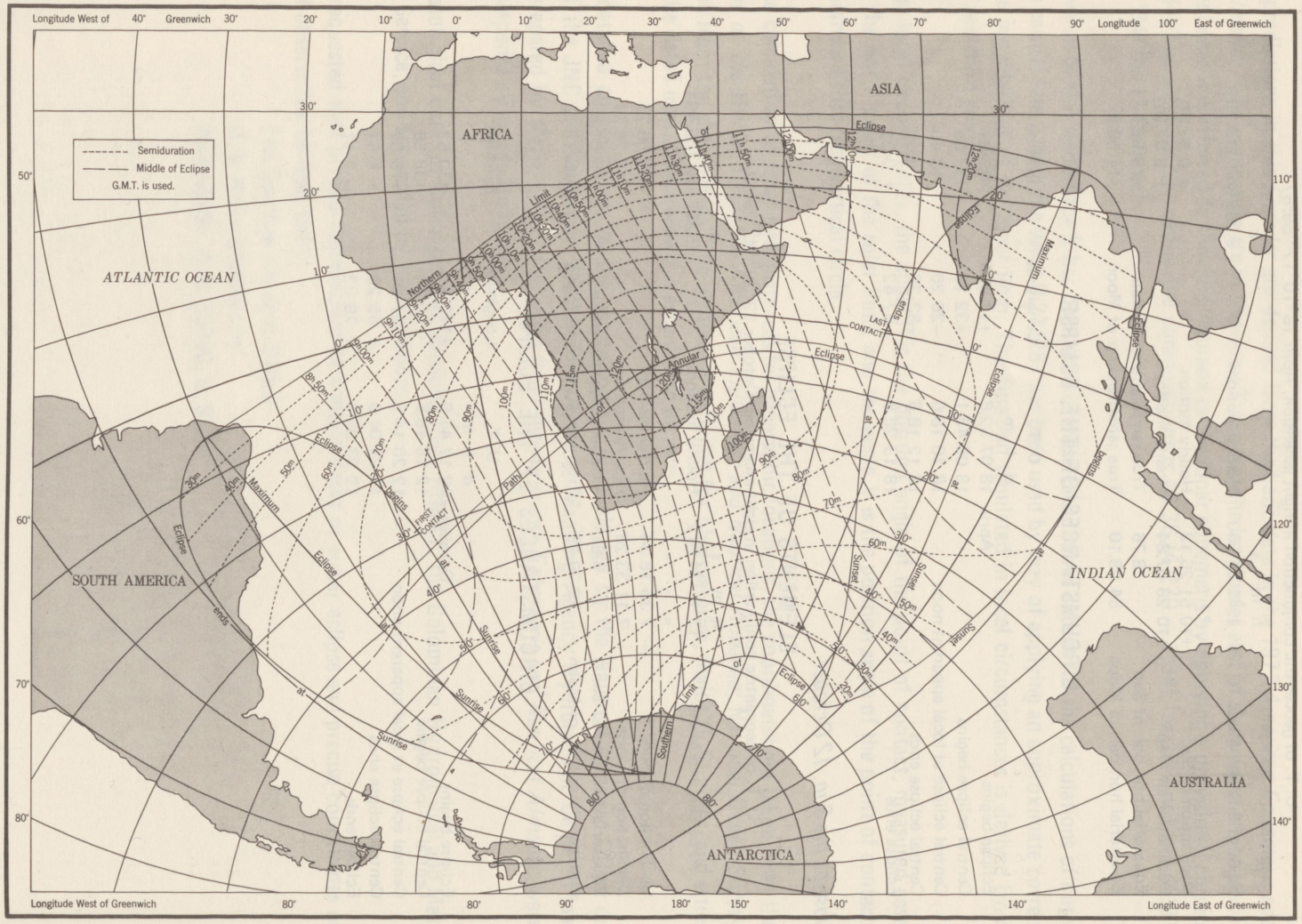
U. T. of geocentric conjunction in right ascension, October $12^d20^h14^m28^s.12$

	h m s		s s
R. A. of Sun and Moon	13 11 34.812	Hourly motions	9.247 and 138.494
	° ′ ″		′ ″
Declination of Sun	− 7 35 18.34	Hourly motion	− 0 56.23
Declination of Moon	− 7 11 33.26	Hourly motion	−10 28.94
Equatorial hor. par. of Sun	8.81	True semidiameter of Sun	16 01.8
Equatorial hor. par. of Moon	59 29.49	True semidiameter of Moon	16 12.6

CIRCUMSTANCES OF THE ECLIPSE

		U. T.	Longitude	Latitude
		d h m	° ′	° ′
Eclipse begins	October	12 17 47.6	+175 44	+30 52
Central eclipse begins		12 18 48.5	−170 40	+38 58
Central eclipse at local apparent noon		12 20 14.5	+127 01	+16 07
Central eclipse ends		12 22 04.9	+ 65 26	+ 5 57
Eclipse ends		12 23 05.7	+ 79 32	− 2 11

ANNULAR SOLAR ECLIPSE OF 1977 APRIL 18



PATH OF THE ANNULAR PHASE

Universal Time	Northern Limit		Central Line		Southern Limit	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
h m	° ′	° ′	° ′	° ′	° ′	° ′
Limit	-36 53	+ 32 29	-38 05	+ 32 18	-39 17	+ 32 08
8 43	-35 29.0	+ 25 47.6	.. .. .	... .. .	.. .. .	... .. .
44	34 35.0	22 04.4	-36 19.5	+ 24 14.4	-38 42.4	+ 29 18.1
45	33 53.9	19 28.4	35 27.8	20 51.4	37 13.5	22 58.5
46	33 18.8	17 23.4	34 47.1	18 23.2	36 22.8	19 47.4
47	32 47.4	15 37.0	34 11.9	16 22.4	35 42.0	17 24.1
8 48	-32 18.6	+ 14 03.6	-33 40.3	+ 14 38.8	-35 06.5	+ 15 26.2
50	31 26.4	11 23.5	32 44.0	11 45.1	34 04.9	12 14.5
52	30 39.4	9 08.0	31 53.9	9 20.7	33 11.1	9 39.0
54	29 56.0	7 09.5	31 08.1	7 15.9	32 22.5	7 26.5
56	29 15.4	5 23.9	30 25.4	5 25.4	31 37.7	5 30.3
58	28 37.0	3 48.1	29 45.4	3 45.9	30 55.7	3 46.4
9 00	-28 00.4	+ 2 20.5	-29 07.4	+ 2 15.1	-30 16.0	+ 2 12.1
05	26 35.4	- 0 51.9	27 39.4	- 1 02.9	28 44.8	- 1 12.3
10	25 17.5	3 36.0	26 19.1	3 50.8	27 22.0	4 04.5
15	24 05.0	5 59.8	25 04.7	6 17.4	26 05.5	6 34.2
20	22 56.8	8 08.3	23 54.9	8 28.0	24 54.1	8 47.0
25	21 52.2	10 04.9	22 49.0	10 26.2	23 46.9	10 47.0
9 30	-20 50.7	- 11 52.0	-21 46.5	- 12 14.5	-22 43.1	- 12 36.7
35	19 52.0	13 31.3	20 46.8	13 54.9	21 42.5	14 18.1
40	18 55.6	15 04.4	19 49.7	15 28.7	20 44.6	15 52.8
45	18 01.5	16 32.2	18 54.9	16 57.2	19 49.1	17 22.0
50	17 09.3	17 55.6	18 02.2	18 21.2	18 55.9	18 46.6
55	16 19.0	19 15.5	17 11.5	19 41.5	18 04.8	20 07.4
10 00	-15 30.4	- 20 32.5	-16 22.6	- 20 58.8	-17 15.6	- 21 25.1
05	14 43.5	21 47.0	15 35.4	22 13.7	16 28.2	22 40.3
10	13 58.0	22 59.7	14 49.9	23 26.6	15 42.5	23 53.5
15	13 14.1	24 10.9	14 05.9	24 38.0	14 58.5	25 05.1
20	12 31.6	25 21.0	13 23.4	25 48.3	14 16.0	26 15.6
25	11 50.5	26 30.4	12 42.4	26 57.9	13 35.1	27 25.3
10 30	-11 10.8	- 27 39.6	-12 02.8	- 28 07.1	-12 55.7	- 28 34.7
35	10 32.4	28 48.7	11 24.7	29 16.3	12 17.8	29 44.0
40	9 55.3	29 58.2	10 47.9	30 25.9	11 41.3	30 53.6
45	9 19.6	31 08.4	10 12.6	31 36.1	11 06.3	32 04.0
50	8 45.3	32 19.6	9 38.6	32 47.4	10 32.8	33 15.3
55	8 12.3	33 32.3	9 06.1	34 00.1	10 00.7	34 28.1
11 00	- 7 40.7	- 34 46.8	- 8 35.0	- 35 14.7	- 9 30.2	- 35 42.7
05	7 10.6	36 03.5	8 05.5	36 31.4	9 01.2	36 59.6
10	6 42.0	37 22.9	7 37.5	37 50.9	8 33.8	38 19.2
15	6 14.9	38 45.5	7 11.1	39 13.6	8 08.2	39 42.1
20	5 49.6	40 12.0	6 46.5	40 40.3	7 44.3	41 08.9
25	5 26.1	41 43.1	6 23.8	42 11.6	7 22.4	42 40.5
11 30	- 5 04.5	- 43 19.6	- 6 03.1	- 43 48.4	- 7 02.6	- 44 17.7
35	4 45.1	45 02.6	5 44.7	45 31.8	6 45.2	46 01.7
40	4 28.1	46 53.6	5 28.8	47 23.4	6 30.3	47 54.0
45	4 14.0	48 54.2	5 15.8	49 24.9	6 18.5	49 56.5
50	4 03.1	51 07.1	5 06.2	51 39.0	6 10.3	52 12.1
55	3 56.2	53 35.8	5 00.8	54 09.5	6 06.6	54 44.8
12 00	- 3 54.4	- 56 25.9	- 5 00.9	- 57 02.4	- 6 08.6	- 57 41.0
05	3 59.5	59 46.8	5 08.5	60 28.2	6 18.9	61 12.5
10	4 15.4	63 57.9	5 28.0	64 48.5	6 42.5	65 44.2
12 12	- 4 26.6	- 66 01.4	- 5 41.3	- 66 58.8	- 6 58.4	- 68 03.1
14	4 42.1	68 27.0	5 59.9	69 35.3	7 21.1	70 54.4
16	5 04.9	71 29.3	6 28.2	72 59.3	7 57.5	74 52.9
12 17	- 5 21.1	- 73 25.1	- 6 49.6	- 75 18.2	- 8 29.8	- 78 02.1
18	5 43.7	75 54.3	- 7 24.7	- 78 47.2	.. .. .	... .. .
19	6 25.0	80 01.8	.. .. .	... .. .	.. .. .	... .. .
Limit	- 7 05	- 83 39	- 8 18	- 83 36	- 9 32	- 83 34

CENTRAL LINE OF ANNULAR PHASE

Universal Time	10,000 Feet		20,000 Feet		30,000 Feet		40,000 Feet	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
h m	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
8 43	.. .. .	... .. .	-37 44.0	+ 30 38.7	-37 30.2	+ 29 34.4	-37 20.1	+ 28 49.5
44	-36 15.1	23 58.6	36 10.8	23 43.4	36 06.6	23 28.6	36 02.5	23 14.2
45	35 24.5	20 40.7	35 21.1	20 30.2	35 17.9	20 19.9	35 14.6	20 09.8
46	34 44.2	18 14.7	34 41.3	18 06.3	34 38.4	17 58.1	34 35.6	17 49.9
47	34 09.3	16 15.2	34 06.7	16 08.1	34 04.1	16 01.1	34 01.5	15 54.1
8 48	-33 37.8	+ 14 32.6	-33 35.4	+ 14 26.3	-33 33.0	+ 14 20.2	-33 30.6	+ 14 14.1
50	32 41.8	11 40.0	32 39.6	11 35.0	32 37.4	11 29.9	32 35.2	11 25.0
52	31 51.8	9 16.3	31 49.8	9 12.0	31 47.8	9 07.8	31 45.8	9 03.5
54	31 06.2	7 12.1	31 04.3	7 08.4	31 02.4	7 04.6	31 00.5	7 00.9
56	30 23.7	5 22.0	30 21.9	5 18.7	30 20.1	5 15.4	30 18.3	5 12.1
58	29 43.7	3 42.8	29 42.0	3 39.8	29 40.3	3 36.8	29 38.6	3 33.9
9 00	-29 05.7	+ 2 12.4	-29 04.1	+ 2 09.6	-29 02.5	+ 2 06.9	-29 00.8	+ 2 04.2
05	27 37.9	- 1 05.1	27 36.4	- 1 07.3	27 34.9	- 1 09.5	27 33.4	- 1 11.7
10	26 17.7	3 52.7	26 16.4	3 54.5	26 15.0	3 56.4	26 13.6	3 58.2
15	25 03.4	6 19.0	25 02.1	6 20.5	25 00.8	6 22.1	24 59.5	6 23.6
20	23 53.7	8 29.3	23 52.5	8 30.7	23 51.3	8 32.0	23 50.1	8 33.3
25	22 47.9	10 27.3	22 46.7	10 28.5	22 45.6	10 29.6	22 44.4	10 30.7
9 30	-21 45.4	- 12 15.5	-21 44.3	- 12 16.5	-21 43.2	- 12 17.4	-21 42.1	- 12 18.4
35	20 45.7	13 55.7	20 44.7	13 56.5	20 43.7	13 57.4	20 42.6	13 58.2
40	19 48.7	15 29.4	19 47.7	15 30.1	19 46.7	15 30.8	19 45.7	15 31.5
45	18 53.9	16 57.8	18 53.0	16 58.3	18 52.0	16 58.9	18 51.1	16 59.5
50	18 01.3	18 21.7	18 00.4	18 22.1	17 59.5	18 22.6	17 58.5	18 23.1
55	17 10.6	19 41.9	17 09.7	19 42.3	17 08.8	19 42.7	17 08.0	19 43.1
10 00	-16 21.8	- 20 59.1	-16 20.9	- 20 59.4	-16 20.1	- 20 59.7	-16 19.2	- 21 00.0
05	15 34.6	22 13.9	15 33.8	22 14.1	15 33.0	22 14.3	15 32.1	22 14.5
10	14 49.1	23 26.7	14 48.3	23 26.8	14 47.5	23 27.0	14 46.7	23 27.1
15	14 05.1	24 38.0	14 04.4	24 38.1	14 03.6	24 38.1	14 02.8	24 38.2
20	13 22.7	25 48.2	13 22.0	25 48.2	13 21.2	25 48.2	13 20.5	25 48.2
25	12 41.7	26 57.8	12 41.0	26 57.6	12 40.3	26 57.5	12 39.6	26 57.4
10 30	-12 02.2	- 28 06.9	-12 01.5	- 28 06.7	-12 00.8	- 28 06.5	-12 00.1	- 28 06.4
35	11 24.0	29 16.1	11 23.3	29 15.8	11 22.7	29 15.5	11 22.0	29 15.3
40	10 47.3	30 25.5	10 46.6	30 25.2	10 45.9	30 24.9	10 45.3	30 24.6
45	10 11.9	31 35.7	10 11.3	31 35.3	10 10.6	31 34.9	10 10.0	31 34.5
50	9 38.0	32 46.9	9 37.3	32 46.5	9 36.7	32 46.0	9 36.1	32 45.5
55	9 05.5	33 59.6	9 04.9	33 59.0	9 04.2	33 58.4	9 03.6	33 57.9
11 00	- 8 34.4	- 35 14.0	- 8 33.8	- 35 13.4	- 8 33.2	- 35 12.7	- 8 32.6	- 35 12.1
05	8 04.9	36 30.7	8 04.3	36 29.9	8 03.7	36 29.2	8 03.1	36 28.5
10	7 36.9	37 50.1	7 36.3	37 49.3	7 35.7	37 48.4	7 35.1	37 47.6
15	7 10.6	39 12.7	7 10.0	39 11.8	7 09.4	39 10.9	7 08.8	39 10.0
20	6 46.0	40 39.3	6 45.4	40 38.2	6 44.8	40 37.2	6 44.2	40 36.2
25	6 23.2	42 10.4	6 22.7	42 09.3	6 22.1	42 08.2	6 21.5	42 07.0
11 30	- 6 02.5	- 43 47.1	- 6 02.0	- 43 45.8	- 6 01.4	- 43 44.6	- 6 00.8	- 43 43.3
35	5 44.1	45 30.4	5 43.5	45 29.0	5 42.9	45 27.6	5 42.3	45 26.2
40	5 28.2	47 21.8	5 27.6	47 20.3	5 27.0	47 18.7	5 26.4	47 17.1
45	5 15.1	49 23.2	5 14.5	49 21.4	5 13.9	49 19.7	5 13.3	49 17.9
50	5 05.5	51 37.0	5 04.9	51 35.1	5 04.2	51 33.1	5 03.6	51 31.1
55	5 00.1	54 07.3	4 59.5	54 05.0	4 58.8	54 02.8	4 58.1	54 00.5
12 00	- 5 00.1	- 56 59.8	- 4 59.4	- 56 57.1	- 4 58.6	- 56 54.5	- 4 57.9	- 56 51.9
05	5 07.6	60 25.0	5 06.8	60 21.8	5 05.9	60 18.6	5 05.1	60 15.4
10	5 27.0	64 44.3	5 25.9	64 40.1	5 24.9	64 36.0	5 23.9	64 31.9
12 12	- 5 46.1	- 66 53.9	- 5 39.0	- 66 49.1	- 5 37.8	- 66 44.3	- 5 36.7	- 66 39.5
14	5 58.6	69 29.3	5 57.2	69 23.5	5 55.9	69 17.6	5 54.5	69 11.9
16	6 26.4	72 51.2	6 24.6	72 43.3	6 22.9	72 35.5	6 21.1	72 27.7
12 17	- 6 47.3	- 75 07.8	- 6 45.1	- 74 57.5	- 6 42.9	- 74 47.5	- 6 40.8	- 74 37.7
18	- 7 21.0	- 78 29.1	- 7 17.4	- 78 12.0	- 7 14.0	- 77 55.8	- 7 10.8	- 77 40.3

DURATION OF ANNULAR PHASE AND WIDTH OF PATH ON CENTRAL LINE

Universal Time	10,000 Feet		20,000 Feet		30,000 Feet		40,000 Feet	
	Duration	Width of Path	Duration	Width of Path	Duration	Width of Path	Duration	Width of Path
h m	m s	*mi*	m s	*mi*	m s	*mi*	m s	*mi*
8 43	. .. .	...	4 51.4	164	4 52.6	164	4 53.5	164
44	4 59.4	159	4 59.7	159	4 60.0	160	5 00.3	159
45	5 03.8	157	5 04.0	157	5 04.2	157	5 04.5	157
46	5 07.3	155	5 07.5	156	5 07.7	156	5 07.9	155
47	5 10.3	154	5 10.5	154	5 10.7	154	5 10.9	154
8 48	5 13.1	153	5 13.2	153	5 13.4	152	5 13.6	152
50	5 18.0	151	5 18.2	151	5 18.3	151	5 18.4	150
52	5 22.4	149	5 22.6	149	5 22.7	148	5 22.8	149
54	5 26.5	148	5 26.6	148	5 26.7	147	5 26.9	147
56	5 30.3	146	5 30.4	146	5 30.5	146	5 30.7	146
58	5 33.9	145	5 34.0	144	5 34.1	144	5 34.2	145
9 00	5 37.3	144	5 37.4	144	5 37.5	144	5 37.7	144
05	5 45.3	141	5 45.4	141	5 45.5	141	5 45.6	141
10	5 52.7	140	5 52.8	140	5 52.9	140	5 53.0	139
15	5 59.6	138	5 59.7	138	5 59.8	138	5 59.9	137
20	6 06.0	136	6 06.1	136	6 06.3	137	6 06.4	137
25	6 12.1	136	6 12.2	136	6 12.3	136	6 12.4	135
9 30	6 17.9	135	6 18.0	135	6 18.1	134	6 18.2	134
35	6 23.2	134	6 23.3	134	6 23.4	134	6 23.6	133
40	6 28.3	133	6 28.4	133	6 28.5	133	6 28.6	133
45	6 33.0	133	6 33.1	133	6 33.2	133	6 33.3	133
50	6 37.4	132	6 37.5	132	6 37.6	133	6 37.7	133
55	6 41.4	132	6 41.5	132	6 41.6	133	6 41.7	133
10 00	6 45.1	132	6 45.2	132	6 45.3	133	6 45.4	133
05	6 48.3	132	6 48.5	132	6 48.6	133	6 48.7	133
10	6 51.3	133	6 51.4	133	6 51.5	133	6 51.6	133
15	6 53.7	133	6 53.9	133	6 54.0	133	6 54.1	133
20	6 55.9	134	6 56.0	134	6 56.1	134	6 56.2	133
25	6 57.5	135	6 57.6	134	6 57.7	134	6 57.8	134
10 30	6 58.6	135	6 58.8	135	6 58.9	135	6 59.0	135
35	6 59.4	136	6 59.5	136	6 59.6	136	6 59.7	136
40	6 59.6	136	6 59.7	136	6 59.8	137	7 00.0	137
45	6 59.3	137	6 59.4	137	6 59.6	137	6 59.7	137
50	6 58.6	138	6 58.7	138	6 58.8	138	6 58.9	138
55	6 57.2	139	6 57.4	139	6 57.5	139	6 57.6	139
11 00	6 55.4	140	6 55.5	140	6 55.6	140	6 55.8	140
05	6 53.0	141	6 53.1	141	6 53.3	140	6 53.4	141
10	6 50.1	142	6 50.2	142	6 50.3	142	6 50.5	141
15	6 46.6	143	6 46.8	143	6 46.9	143	6 47.0	143
20	6 42.6	144	6 42.7	144	6 42.9	144	6 43.0	144
25	6 38.1	144	6 38.2	144	6 38.3	144	6 38.4	145
11 30	6 32.9	145	6 33.1	145	6 33.2	145	6 33.3	145
35	6 27.3	147	6 27.4	146	6 27.6	146	6 27.7	146
40	6 21.1	148	6 21.2	148	6 21.4	147	6 21.5	147
45	6 14.3	148	6 14.4	148	6 14.6	148	6 14.7	149
50	6 06.9	149	6 07.0	149	6 07.2	149	6 07.3	149
55	5 58.9	151	5 59.0	151	5 59.1	151	5 59.3	151
12 00	5 50.0	152	5 50.2	152	5 50.3	152	5 50.5	152
05	5 40.3	154	5 40.4	154	5 40.5	154	5 40.7	154
10	5 29.0	156	5 29.1	156	5 29.3	156	5 29.5	156
12 12	5 23.8	157	5 24.0	157	5 24.2	157	5 24.4	157
14	5 18.0	159	5 18.2	159	5 18.4	159	5 18.6	159
16	5 11.1	161	5 11.3	161	5 11.6	160	5 11.8	160
12 17	5 06.7	162	5 07.0	162	5 07.3	162	5 07.6	162
18	5 00.8	164	5 01.3	164	5 01.7	164	5 02.1	164

CENTRAL LINE OF ANNULAR PHASE

Universal Time	80 Km		100 Km		200 Km		300 Km	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
h m	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
8 38	.. .. .	... .. .	.. .. .	... .. .	.. .. .	... .. .	-35 17.3	+ 23 18.0
39	.. .. .	... .. .	.. .. .	... .. .	.. .. .	... .. .	34 27.6	20 02.1
40	.. .. .	... .. .	.. .. .	... .. .	-35 37.0	+ 23 35.8	33 48.4	17 38.8
41	.. .. .	... .. .	.. .. .	... .. .	34 46.8	20 18.0	33 14.5	15 42.0
8 42	-36 29.3	+ 25 54.0	-35 57.7	+ 23 54.6	-34 07.1	+ 17 53.4	-32 44.0	+ 14 01.9
44	34 46.0	19 05.7	34 26.7	18 08.1	33 02.0	14 14.2	31 49.6	11 14.0
46	33 36.7	15 08.3	33 20.7	14 26.5	32 07.0	11 24.5	31 01.3	8 54.4
48	32 39.4	12 08.6	32 25.1	11 34.9	31 18.2	9 03.4	30 17.2	6 53.8
8 50	-31 48.8	+ 9 40.7	-31 35.6	+ 9 12.2	-30 33.4	+ 7 01.5	-29 36.0	+ 5 07.1
55	29 59.5	4 50.3	29 48.2	4 29.4	28 53.9	+ 2 51.2	28 02.9	+ 1 22.4
9 00	-28 25.5	+ 1 05.8	-28 15.3	+ 0 49.3	-27 26.2	- 0 29.2	-26 39.6	- 1 41.5
05	27 01.0	- 1 59.4	26 51.7	- 2 13.0	26 06.4	3 17.9	25 23.2	4 18.3
10	25 43.5	4 38.0	25 34.8	4 49.4	24 52.5	5 44.1	24 12.1	6 35.5
15	24 31.3	6 57.4	24 23.2	7 07.0	23 43.4	7 53.7	23 05.4	8 37.8
20	23 23.5	9 02.1	23 15.8	9 10.4	22 38.2	9 50.5	22 02.1	10 28.4
25	22 19.2	10 55.4	22 11.9	11 02.5	21 36.3	11 37.0	21 02.0	12 09.8
9 30	-21 18.1	- 12 39.6	-21 11.2	- 12 45.7	-20 37.2	- 13 15.3	-20 04.5	- 13 43.6
35	20 19.7	14 16.3	20 13.1	14 21.5	19 40.7	14 46.9	19 09.4	15 11.1
40	19 23.8	15 46.8	19 17.5	15 51.3	18 46.4	16 12.8	18 16.5	16 33.5
45	18 30.1	17 12.3	18 24.0	17 16.1	17 54.2	17 34.1	17 25.5	17 51.5
50	17 38.4	18 33.6	17 32.6	18 36.7	17 04.0	18 51.6	16 36.3	19 05.9
55	16 48.6	19 51.5	16 43.0	19 53.9	16 15.5	20 05.8	15 48.9	20 17.3
10 00	-16 00.6	- 21 06.4	-15 55.1	- 21 08.3	-15 28.6	- 21 17.4	-15 03.0	- 21 26.2
05	15 14.2	22 19.1	15 08.9	22 20.4	14 43.4	22 26.8	14 18.6	22 33.0
10	14 29.4	23 29.8	14 24.3	23 30.6	13 59.6	23 34.5	13 35.7	23 38.3
15	13 46.1	24 39.2	13 41.2	24 39.5	13 17.3	24 40.9	12 54.2	24 42.3
20	13 04.2	25 47.5	12 59.5	25 47.3	12 36.4	25 46.3	12 14.0	25 45.4
25	12 23.8	26 55.1	12 19.2	26 54.4	11 56.8	26 51.1	11 35.1	26 47.9
10 30	-11 44.8	- 28 02.4	-11 40.3	- 28 01.2	-11 18.6	- 27 55.6	-10 57.5	- 27 50.2
35	11 07.1	29 09.7	11 02.8	29 08.1	10 41.6	29 00.1	10 21.1	28 52.4
40	10 30.8	30 17.3	10 26.6	30 15.2	10 06.0	30 04.9	9 46.1	29 55.0
45	9 55.9	31 25.6	9 51.8	31 23.0	9 31.7	31 10.4	9 12.2	30 58.2
50	9 22.3	32 34.9	9 18.3	32 31.8	8 58.7	32 16.8	8 39.7	32 02.3
55	8 50.1	33 45.6	8 46.2	33 42.0	8 27.0	33 24.5	8 08.4	33 07.6
11 00	- 8 19.4	- 34 58.0	- 8 15.5	- 34 53.9	- 7 56.6	- 34 33.9	- 7 38.4	- 34 14.5
05	7 50.0	36 12.5	7 46.3	36 07.9	7 27.7	35 45.2	7 09.7	35 23.3
10	7 22.3	37 29.7	7 18.5	37 24.5	7 00.2	36 59.0	6 42.5	36 34.5
15	6 56.1	38 49.9	6 52.3	38 44.1	6 34.2	38 15.7	6 16.7	37 48.3
20	6 31.5	40 13.9	6 27.8	40 07.4	6 09.8	39 35.8	5 52.4	39 05.5
25	6 08.8	41 42.3	6 05.1	41 35.1	5 47.1	41 00.1	5 29.8	40 26.4
11 30	- 5 48.0	- 43 15.9	- 5 44.3	- 43 07.9	- 5 26.3	- 42 29.1	- 5 08.9	- 41 51.9
35	5 29.4	44 55.7	5 25.7	44 46.9	5 07.4	44 03.9	4 49.9	43 22.8
40	5 13.2	46 43.2	5 09.4	46 33.4	4 50.8	45 45.6	4 32.9	45 00.0
45	4 59.7	48 39.9	4 55.8	48 28.9	4 36.7	47 35.7	4 18.4	46 45.0
50	4 49.4	50 48.2	4 45.3	50 35.9	4 25.5	49 36.1	4 06.6	48 39.4
55	4 43.1	53 11.5	4 38.7	52 57.5	4 17.8	51 49.7	3 57.9	50 45.7
12 00	- 4 41.6	- 55 54.9	- 4 36.9	- 55 38.6	- 4 14.4	- 54 20.4	- 3 53.2	- 53 07.3
05	4 46.8	59 06.8	4 41.6	58 47.4	4 16.7	57 14.9	3 53.5	55 49.4
10	5 02.0	63 04.0	4 55.9	62 39.5	4 26.9	60 44.8	4 00.5	59 01.2
12 12	- 5 12.4	- 64 59.1	- 5 05.7	- 64 31.4	- 4 34.2	- 62 23.4	- 4 05.9	- 60 29.7
14	5 26.6	67 12.6	5 19.0	66 40.4	4 44.1	64 14.3	4 13.3	62 07.4
16	5 46.7	69 54.9	5 37.7	69 15.4	4 57.5	66 22.2	4 23.3	63 57.3
18	6 17.8	73 32.4	6 05.8	72 37.4	5 16.2	68 55.8	4 36.8	66 04.0
12 20	- 7 36.0	- 81 10.2	- 7 01.8	- 78 21.2	- 5 44.3	- 72 16.1	- 4 55.5	- 68 36.4
21	.. .. .	... .. .	.. .. .	... .. .	6 05.5	74 32.4	5 07.9	70 07.7
22	.. .. .	... .. .	.. .. .	... .. .	- 6 40.0	- 77 56.8	5 23.6	71 55.2
23	.. .. .	... .. .	.. .. .	... .. .	.. .. .	... .. .	5 44.7	74 10.6
24	.. .. .	... .. .	.. .. .	... .. .	.. .. .	... .. .	- 6 19.1	- 77 33.7

DURATION OF ANNULAR PHASE AND WIDTH OF PATH ON CENTRAL LINE

Universal Time	80 Km		100 Km		200 Km		300 Km	
	Duration	Width of Path	Duration	Width of Path	Duration	Width of Path	Duration	Width of Path
h m	m s	mi	m s	mi	m s	mi	m s	mi
8 38	. .. .	...	. .. .	...	. .. .	...	4 59.0	159
39	. .. .	...	. .. .	...	. .. .	...	5 03.6	156
40	. .. .	...	. .. .	...	4 59.0	159	5 07.2	154
41	. .. .	...	. .. .	...	5 03.6	156	5 10.4	153
8 42	4 56.6	161	4 59.0	159	5 07.2	155	5 13.2	151
44	5 05.8	156	5 07.1	155	5 13.1	152	5 18.3	149
46	5 11.9	153	5 13.0	152	5 18.2	150	5 22.9	148
48	5 17.0	151	5 18.0	151	5 22.7	148	5 27.1	146
8 50	5 21.6	148	5 22.5	148	5 26.9	146	5 31.0	144
55	5 31.5	145	5 32.3	145	5 36.2	143	5 40.1	142
9 00	5 40.2	142	5 40.9	142	5 44.6	141	5 48.3	139
05	5 48.1	140	5 48.8	140	5 52.4	138	5 55.9	137
10	5 55.4	138	5 56.1	138	5 59.6	137	6 03.1	135
15	6 02.2	137	6 02.9	137	6 06.4	136	6 09.9	134
20	6 08.7	136	6 09.4	135	6 12.8	134	6 16.3	133
25	6 14.8	135	6 15.4	134	6 18.9	133	6 22.4	132
9 30	6 20.5	134	6 21.2	134	6 24.7	132	6 28.1	131
35	6 25.9	133	6 26.6	133	6 30.1	132	6 33.6	130
40	6 31.0	132	6 31.7	132	6 35.2	132	6 38.8	130
45	6 35.7	132	6 36.4	132	6 40.0	131	6 43.6	129
50	6 40.1	132	6 40.8	132	6 44.4	131	6 48.1	129
55	6 44.2	132	6 44.9	131	6 48.5	131	6 52.2	129
10 00	6 47.9	132	6 48.6	132	6 52.3	131	6 56.0	129
05	6 51.2	132	6 51.9	132	6 55.7	131	6 59.5	129
10	6 54.1	132	6 54.9	132	6 58.7	131	7 02.5	130
15	6 56.6	132	6 57.4	132	7 01.3	132	7 05.2	130
20	6 58.8	133	6 59.5	133	7 03.4	132	7 07.4	131
25	7 00.4	133	7 01.2	134	7 05.2	132	7 09.2	131
10 30	7 01.7	134	7 02.5	134	7 06.5	133	7 10.5	132
35	7 02.4	135	7 03.2	134	7 07.3	133	7 11.4	133
40	7 02.7	136	7 03.5	135	7 07.6	134	7 11.7	134
45	7 02.4	136	7 03.2	136	7 07.4	135	7 11.6	134
50	7 01.7	137	7 02.5	137	7 06.7	136	7 10.9	135
55	7 00.4	138	7 01.2	138	7 05.4	137	7 09.7	136
11 00	6 58.6	139	6 59.4	139	7 03.6	138	7 07.9	137
05	6 56.2	140	6 57.1	140	7 01.3	139	7 05.6	138
10	6 53.3	141	6 54.1	141	6 58.4	140	7 02.8	139
15	6 49.8	142	6 50.7	142	6 55.0	141	6 59.3	139
20	6 45.8	143	6 46.7	142	6 51.0	141	6 55.3	140
25	6 41.3	144	6 42.1	143	6 46.4	142	6 50.8	141
11 30	6 36.2	144	6 37.0	144	6 41.3	143	6 45.7	142
35	6 30.5	145	6 31.4	145	6 35.7	144	6 40.1	143
40	6 24.3	146	6 25.2	147	6 29.5	145	6 33.9	144
45	6 17.6	148	6 18.4	147	6 22.7	146	6 27.1	145
50	6 10.2	148	6 11.1	148	6 15.4	147	6 19.8	146
55	6 02.2	149	6 03.1	150	6 07.5	148	6 12.0	147
12 00	5 53.5	151	5 54.4	151	5 58.9	150	6 03.4	149
05	5 43.9	152	5 44.9	152	5 49.5	151	5 54.2	149
10	5 33.0	155	5 34.1	155	5 39.1	153	5 44.1	152
12 12	5 28.2	156	5 29.2	155	5 34.6	154	5 39.7	153
14	5 22.8	157	5 24.0	157	5 29.7	155	5 35.0	154
16	5 16.8	159	5 18.1	159	5 24.3	156	5 30.1	154
18	5 09.3	161	5 11.0	160	5 18.3	158	5 24.6	156
12 20	4 56.0	165	5 00.5	164	5 11.2	160	5 18.6	158
21	. .. .	...	. .. .	...	5 06.7	161	5 15.2	159
22	. .. .	...	. .. .	...	5 00.5	163	5 11.3	159
23	. .. .	...	. .. .	...	. .. .	...	5 06.8	161
24	. .. .	...	. .. .	...	. .. .	...	5 00.5	163

LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

Central Line Universal Time	Central Line Latitude	Central Line Longitude	First Contact Universal Time	First Contact P	First Contact V	Second Contact Universal Time	Second Contact P	Second Contact V
h m	° ′	° ′	h m s	°	°	h m s	°	°
8 44	-36 19.5	+ 24 14.4	.. ..	...	...	8 41 30.5	248	17
45	35 27.8	20 51.4	.. ..	...	...	8 42 28.3	248	17
46	34 47.1	18 23.2	.. ..	...	...	8 43 26.5	247	16
47	34 11.9	16 22.4	.. ..	...	...	8 44 24.9	247	16
8 48	-33 40.3	+ 14 38.8	7 33 52.4	248	12	8 45 23.6	247	16
50	32 44.0	11 45.1	7 34 01.3	247	12	8 47 21.1	246	16
52	31 53.9	9 20.7	7 34 21.7	247	11	8 49 18.9	246	16
54	31 08.1	7 15.9	7 34 50.0	247	10	8 51 16.9	245	16
56	30 25.4	5 25.4	7 35 24.1	246	10	8 53 14.9	245	16
58	29 45.4	3 45.9	7 36 02.6	246	9	8 55 13.1	244	16
9 00	-29 07.4	+ 2 15.1	7 36 44.7	245	9	8 57 11.4	244	16
05	27 39.4	- 1 02.9	7 38 42.1	245	8	9 02 07.4	243	17
10	26 19.1	3 50.8	7 40 52.5	244	7	9 07 03.7	242	17
15	25 04.7	6 17.4	7 43 12.7	243	7	9 12 00.3	242	18
20	23 54.9	8 28.0	7 45 40.8	243	6	9 16 57.1	241	20
25	22 49.0	10 26.2	7 48 15.7	242	6	9 21 54.0	241	21
9 30	-21 46.5	- 12 14.5	7 50 56.5	242	6	9 26 51.2	241	23
35	20 46.8	13 54.9	7 53 42.6	241	5	9 31 48.5	240	25
40	19 49.7	15 28.7	7 56 33.8	241	5	9 36 46.0	240	27
45	18 54.9	16 57.2	7 59 30.1	241	5	9 41 43.6	240	30
50	18 02.2	18 21.2	8 02 31.1	241	6	9 46 41.4	240	33
55	17 11.5	19 41.5	8 05 37.0	240	6	9 51 39.4	240	36
10 00	-16 22.6	- 20 58.8	8 08 47.9	240	6	9 56 37.6	240	40
05	15 35.4	22 13.7	8 12 04.0	240	7	10 01 35.9	240	45
10	14 49.9	23 26.6	8 15 25.3	240	8	10 06 34.5	240	50
15	14 05.9	24 38.0	8 18 52.3	240	8	10 11 33.2	241	55
20	13 23.4	25 48.3	8 22 25.2	240	10	10 16 32.2	241	61
25	12 42.4	26 57.9	8 26 04.6	240	11	10 21 31.4	241	67
10 30	-12 02.8	- 28 07.1	8 29 50.7	240	13	10 26 30.8	242	74
35	11 24.7	29 16.3	8 33 44.2	240	15	10 31 30.4	242	80
40	10 47.9	30 25.9	8 37 45.7	240	17	10 36 30.3	243	87
45	10 12.6	31 36.1	8 41 56.2	240	20	10 41 30.5	243	93
50	9 38.6	32 47.4	8 46 16.0	241	23	10 46 30.8	244	100
55	9 06.1	34 00.1	8 50 46.3	241	27	10 51 31.5	244	105
11 00	- 8 35.0	- 35 14.7	8 55 27.8	241	32	10 56 32.4	245	111
05	8 05.5	36 31.4	9 00 22.0	242	38	11 01 33.6	246	116
10	7 37.5	37 50.9	9 05 29.9	243	45	11 06 35.0	247	121
15	7 11.1	39 13.6	9 10 52.7	243	54	11 11 36.8	247	125
20	6 46.5	40 40.3	9 16 32.4	244	64	11 16 38.8	248	129
25	6 23.8	42 11.6	9 22 30.0	245	74	11 21 41.0	249	133
11 30	- 6 03.1	- 43 48.4	9 28 47.5	245	86	11 26 43.6	250	136
35	5 44.7	45 31.8	9 35 26.4	246	97	11 31 46.4	251	139
40	5 28.8	47 23.4	9 42 29.1	247	107	11 36 49.6	252	142
45	5 15.8	49 24.9	9 49 57.6	248	116	11 41 52.9	253	145
50	5 06.2	51 39.0	9 57 54.1	250	124	11 46 56.6	253	148
55	5 00.8	54 09.5	10 06 21.6	251	130	11 52 00.7	254	150
12 00	- 5 00.9	- 57 02.4	10 15 24.5	252	136	11 57 05.0	255	153
05	5 08.5	60 28.2	10 25 09.8	254	142	12 02 10.0	256	155
10	5 28.0	64 48.5	10 35 52.9	255	147	12 07 15.6	257	157
12 12	- 5 41.3	- 66 58.8	10 40 34.1	256	149	12 09 18.2	258	158
14	5 59.9	69 35.3	10 45 37.7	256	151	12 11 21.1	258	159
16	6 28.2	72 59.3	10 51 19.9	257	153	12 13 24.6	259	160
12 17	- 6 49.6	- 75 18.2	10 54 40.2	258	154	12 14 26.8	259	160
18	- 7 24.7	- 78 47.2	10 58 55.4	258	155	12 15 29.8	260	161

LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

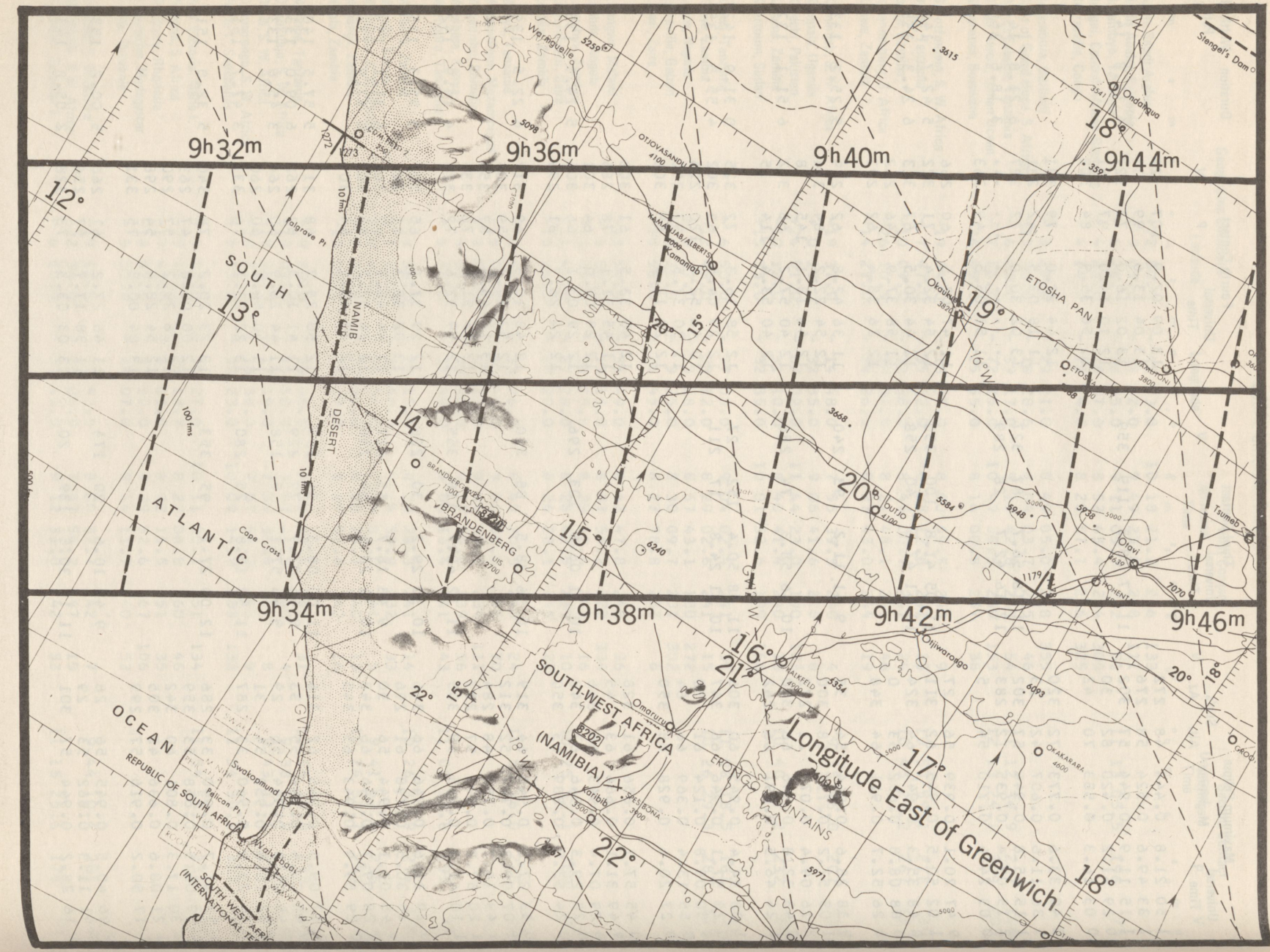
Maximum Eclipse				Third Contact			Fourth Contact			Duration	Width of Path
Universal Time	Magnitude	Sun's Alt.	Sun's Az.	Universal Time	P	V	Universal Time	P	V		
h m s		°	°	h m s	°	°	h m s	°	°	m s	mi
8 44 00.0	0.934	7	71	8 46 29.5	68	197	10 02 21.2	67	203	4 59.0	160
8 45 00.0	0.935	10	69	8 47 31.7	68	197	10 05 45.2	66	204	5 03.4	158
8 46 00.0	0.935	12	67	8 48 33.5	67	197	10 08 38.3	66	204	5 07.0	155
8 47 00.0	0.936	14	66	8 49 35.1	67	197	10 11 15.5	66	205	5 10.2	155
8 48 00.0	0.936	16	65	8 50 36.4	67	197	10 13 42.9	65	205	5 12.8	153
8 50 00.0	0.937	19	63	8 52 38.9	66	196	10 18 18.0	65	207	5 17.8	151
8 52 00.0	0.938	21	61	8 54 41.1	66	196	10 22 35.4	64	208	5 22.2	149
8 54 00.0	0.938	24	60	8 56 43.1	65	196	10 26 40.4	64	210	5 26.2	147
8 56 00.0	0.939	26	58	8 58 45.1	65	197	10 30 35.9	63	211	5 30.2	146
8 58 00.0	0.939	28	57	9 00 46.9	64	197	10 34 23.8	63	213	5 33.8	145
9 00 00.0	0.940	30	56	9 02 48.6	64	197	10 38 05.4	63	215	5 37.2	143
9 05 00.0	0.940	34	53	9 07 52.6	63	197	10 46 55.7	62	219	5 45.2	141
9 10 00.0	0.941	37	50	9 12 56.3	62	198	10 55 18.6	62	224	5 52.6	140
9 15 00.0	0.942	41	48	9 17 59.7	62	200	11 03 18.1	61	229	5 59.4	138
9 20 00.0	0.942	44	45	9 23 02.9	61	201	11 10 56.6	61	235	6 05.8	136
9 25 00.0	0.943	47	42	9 28 06.0	61	203	11 18 15.9	61	241	6 12.0	136
9 30 00.0	0.943	49	40	9 33 08.8	61	204	11 25 17.0	61	247	6 17.6	135
9 35 00.0	0.944	52	37	9 38 11.5	60	207	11 32 01.0	61	254	6 23.0	134
9 40 00.0	0.944	54	34	9 43 14.0	60	209	11 38 28.4	61	259	6 28.0	133
9 45 00.0	0.944	56	30	9 48 16.4	60	212	11 44 40.0	61	265	6 32.8	133
9 50 00.0	0.945	58	27	9 53 18.6	60	216	11 50 36.2	62	271	6 37.2	132
9 55 00.0	0.945	60	23	9 58 20.6	60	219	11 56 17.8	62	276	6 41.2	132
10 00 00.0	0.945	61	18	10 03 22.4	60	224	12 01 45.3	62	281	6 44.8	132
10 05 00.0	0.945	63	14	10 08 24.1	60	228	12 06 59.6	63	285	6 48.2	133
10 10 00.0	0.945	64	9	10 13 25.5	60	234	12 12 00.8	63	290	6 51.0	133
10 15 00.0	0.946	65	3	10 18 26.8	61	239	12 16 49.9	64	294	6 53.6	133
10 20 00.0	0.946	66	358	10 23 27.8	61	245	12 21 27.2	64	297	6 55.6	134
10 25 00.0	0.946	66	352	10 28 28.6	61	252	12 25 53.4	65	301	6 57.2	135
10 30 00.0	0.946	66	346	10 33 29.2	62	258	12 30 09.1	66	304	6 58.4	135
10 35 00.0	0.946	66	340	10 38 29.6	62	264	12 34 14.8	66	307	6 59.2	136
10 40 00.0	0.946	66	334	10 43 29.7	63	271	12 38 11.0	67	310	6 59.4	136
10 45 00.0	0.945	65	328	10 48 29.5	63	277	12 41 58.3	67	312	6 59.0	137
10 50 00.0	0.945	64	323	10 53 29.2	64	283	12 45 37.1	68	315	6 58.4	138
10 55 00.0	0.945	63	318	10 58 28.5	64	288	12 49 07.6	69	317	6 57.0	140
11 00 00.0	0.945	62	313	11 03 27.6	65	293	12 52 30.8	69	319	6 55.2	140
11 05 00.0	0.945	60	309	11 08 26.4	66	298	12 55 46.5	70	321	6 52.8	141
11 10 00.0	0.945	59	306	11 13 25.0	67	303	12 58 55.2	71	324	6 50.0	142
11 15 00.0	0.944	57	303	11 18 23.2	67	307	13 01 57.2	71	326	6 46.4	143
11 20 00.0	0.944	55	300	11 23 21.2	68	310	13 04 52.7	72	327	6 42.4	143
11 25 00.0	0.944	52	297	11 28 19.0	69	314	13 07 41.9	73	329	6 38.0	144
11 30 00.0	0.943	50	295	11 33 16.4	70	317	13 10 24.5	73	331	6 32.8	146
11 35 00.0	0.943	47	293	11 38 13.6	71	320	13 13 00.7	74	333	6 27.2	147
11 40 00.0	0.942	45	291	11 43 10.4	72	323	13 15 30.1	75	334	6 20.8	147
11 45 00.0	0.942	42	290	11 48 07.1	73	326	13 17 52.2	75	336	6 14.2	148
11 50 00.0	0.941	38	288	11 53 03.4	73	328	13 20 06.1	76	337	6 06.8	150
11 55 00.0	0.940	35	287	11 57 59.3	74	331	13 22 10.2	77	339	5 58.6	151
12 00 00.0	0.939	31	286	12 02 55.0	75	333	13 24 02.1	77	340	5 50.0	152
12 05 00.0	0.938	26	285	12 07 50.0	76	335	13 25 36.9	78	341	5 40.0	154
12 10 00.0	0.937	21	284	12 12 44.4	77	337	13 26 44.1	79	343	5 28.8	156
12 12 00.0	0.936	18	283	12 14 41.8	78	338	13 26 58.0	79	343	5 23.6	158
12 14 00.0	0.936	15	283	12 16 38.9	78	339	•• •• •• •	•••	•••	5 17.8	159
12 16 00.0	0.935	11	282	12 18 35.4	79	340	•• •• •• •	•••	•••	5 10.8	161
12 17 00.0	0.934	9	282	12 19 33.2	79	341	•• •• •• •	•••	•••	5 06.4	162
12 18 00.0	0.933	5	282	12 20 30.2	80	341	•• •• •• •	•••	•••	5 00.4	164

LOCAL CIRCUMSTANCES

Geographic Locations	Latitude	Longitude	First Contact Universal Time	First Contact P	First Contact V	Second Contact Universal Time	Second Contact P	Second Contact V
	° ′	° ′	h m s	°	°	h m s	°	°
Aden, Saudi Arabia	+12 50.0	- 45 03.0	10 18 21.2	216	133			
Addis Ababa, Ethiopia	+ 9 03.0	- 38 42.0	9 49 23.8	218	111			
Bagamoyo, Tanzania	- 6 26.0	- 38 55.0	9 11 05.7	242	51	11 13 05.5	196	75
Bangui, Central African Republic	+ 4 23.0	- 18 37.0	8 52 43.4	204	305			
Brazzaville, Congo	- 4 14.0	- 15 14.0	8 20 57.1	216	325			
Bujumbura, Burundi	- 3 22.0	- 29 21.0	8 49 05.0	228	355			
Cape of Good Hope, S. Africa	-33 56.0	- 18 28.6	8 04 03.7	265	46			
Dar Es Salaam, Tanzania	- 6 48.0	- 39 17.0	9 11 42.8	243	54	11 12 34.9	227	106
Diego Garcia, Indian Ocean	- 7 18.0	- 72 25.0	10 49 38.5	259	153	12 13 24.1	309	209
Gaberones, Botswana	-24 45.0	- 25 55.0	8 16 00.8	257	38			
Grootfontein, S. W. Africa	-19 34.0	- 18 07.0	8 00 59.5	243	9			
Iringa, Tanzania	- 7 47.0	- 35 42.0	8 58 12.8	241	33	10 59 59.1	211	80
Isoka, Zambia	-10 09.0	- 32 38.0	8 45 00.7	241	24	10 45 23.2	267	121
Johannesburg, S. Africa	-26 10.9	- 28 04.5	8 21 48.1	261	46			
Kabwe, Zambia	-14 27.0	- 28 26.0	8 27 43.0	244	19			
Kamanjab, S. W. Africa	-19 37.0	- 14 48.0	7 55 39.5	240	4	9 35 46.0	207	353
Kampala, Uganda	+ 0 19.0	- 32 35.0	9 06 41.6	226	0			
Karachi, Pakistan	+24 51.0	- 67 02.0	11 44 23.0	190	123			
Kasama, Zambia	-10 12.0	- 31 10.0	8 40 41.4	240	18	10 40 07.2	232	80
Khartoum, Sudan	+15 33.0	- 32 35.0	10 01 52.6	199	166			
Kilosa, Tanzania	- 6 50.0	- 37 00.0	9 04 02.4	241	39	11 08 18.5	161	35
Kitwe, Zambia	-12 48.0	- 28 12.0	8 29 02.6	241	15	10 26 29.3	287	119
Lagos, Nigeria	+ 6 27.0	- 3 28.0	8 57 43.1	180	272			
Libreville, Gabon	+ 0 30.0	- 9 25.0	8 30 09.7	201	302			
Likasi, Zaire	-10 58.0	- 26 45.0	8 27 58.8	237	6			
Lilongwe, Malawi	-13 58.0	- 33 49.0	8 43 47.8	248	36			
Luanda, Angola	- 8 50.0	- 13 15.0	8 07 54.2	222	334			
Luanshya, Zambia	-13 07.0	- 28 25.0	8 29 12.4	242	16			
Lubumbashi, Zaire	-11 40.0	- 27 28.0	8 28 42.5	239	10	10 25 52.1	200	31
Lusaka, Zambia	-15 26.0	- 28 20.0	8 26 28.1	245	21			
Mbeya, Tanzania	- 8 54.0	- 33 26.0	8 49 20.5	240	24	10 50 16.0	220	80
Mocambique, Mozambique	-15 00.0	- 40 44.0	9 06 35.0	256	70			
Mogadishu, Somalia	+ 2 02.0	- 45 21.0	9 49 39.1	234	111			
Mombasa, Kenya	- 4 04.0	- 39 40.0	9 17 58.0	239	56			
Morogoro, Tanzania	- 6 50.0	- 37 40.0	9 06 13.4	241	43	11 08 33.8	195	71
Mufulira, Zambia	-12 34.0	- 28 15.0	8 29 28.3	241	14	10 26 33.9	274	106
Nairobi, Kenya	- 1 17.0	- 36 50.0	9 14 50.9	232	33			
Namutoni, S. W. Africa	-18 49.0	- 16 56.0	7 59 31.0	241	5	9 41 47.6	235	24
Nchanga, Zambia	-12 33.0	- 27 50.0	8 28 25.7	240	13	10 24 50.7	259	90
Ndola, Zambia	-13 00.0	- 28 37.0	8 29 52.6	242	16			
Njombe, Tanzania	- 9 20.0	- 34 46.0	8 52 45.4	242	31	10 54 10.8	275	139
Okaukuejo, S. W. Africa	-19 09.0	- 15 58.0	7 57 44.5	240	4	9 38 58.9	221	9
Otavi, S. W. Africa	-19 38.0	- 17 19.0	7 59 35.4	242	8	9 43 11.5	295	87
Otjiwarongo, S. W. Africa	-20 27.0	- 16 38.0	7 57 59.2	243	9			
Platte I., Seychelles	- 5 51.0	- 55 23.0	10 09 14.2	253	133	11 54 30.1	305	200
Port Victoria, Mahe I.	- 4 37.0	- 55 27.0	10 11 00.1	251	134	11 54 55.7	234	131
Pretoria, S. Africa	-25 47.3	- 28 13.7	8 22 08.8	260	46			
Salisbury, Rhodesia	-17 43.0	- 31 05.0	8 32 15.5	251	35			
Tananarive, Madagascar	-18 52.0	- 47 30.0	9 29 52.6	267	106			
Tanga, Tanzania	- 5 05.0	- 39 07.0	9 14 11.7	240	52			
Tsumeb, S. W. Africa	-19 12.0	- 17 42.0	8 00 32.7	242	7	9 44 10.4	281	73
Windhoek, S. W. Africa	-22 34.0	- 17 06.0	7 57 54.2	247	15			
Zanzibar, Zanzibar I.	- 6 10.0	- 39 12.0	9 12 31.0	242	53	11 15 25.6	175	55

LOCAL CIRCUMSTANCES

Maximum Eclipse: Universal Time	Magnitude	Sun's Alt.	Sun's Az.	Third Contact: Universal Time	P	V	Fourth Contact: Universal Time	P	V	Duration	Width of Path
h m s		°	°	h m s	°	°	h m s	°	°	m s	*mi*
11 50 21.8	0.444	48	272				13 09 02.9	107	26		
11 33 49.6	0.524	58	276				13 04 13.6	99	13		
11 15 11.9	0.944	57	302	11 17 18.3	119	359	13 02 16.0	73	327	4 12.8	143
10 29 41.2	0.420	82	30				12 10 14.0	97	351		
10 03 16.3	0.583	70	42				11 56 35.9	84	308		
10 49 33.6	0.773	72	320				12 44 22.0	79	331		
9 36 11.6	0.607	42	23				11 18 03.5	42	231		
11 15 45.8	0.944	57	302	11 18 56.7	87	327	13 02 30.0	72	327	6 21.8	143
12 15 03.4	0.935	12	283	12 16 42.7	28	289	.. ..	...	...	3 18.6	160
10 03 24.4	0.710	54	5				11 57 05.5	49	263		
9 47 20.1	0.939	56	27				11 47 02.5	60	266		
11 02 50.5	0.945	62	311	11 05 41.8	100	330	12 54 32.4	71	322	5 42.7	140
10 48 35.3	0.945	64	324	10 51 47.5	40	258	12 44 30.5	67	313	6 24.3	138
10 08 08.8	0.652	53	0				11 58 37.9	46	262		
10 26 52.7	0.911	64	348				12 26 38.4	62	297		
9 38 28.6	0.944	54	35	9 41 11.2	93	240	11 36 42.8	62	259	5 25.2	133
11 05 57.2	0.714	68	300				12 54 22.2	84	344		
12 16 09.4	0.079	21	272				12 46 18.1	145	78		
10 43 32.8	0.946	66	330	10 46 58.3	74	286	12 40 57.2	68	312	6 51.1	137
11 24 46.5	0.291	66	262				12 40 53.4	114	35		
11 08 34.4	0.945	60	306	11 08 50.4	152	27	12 58 16.3	72	325	0 31.9	142
10 28 57.1	0.946	66	347	10 31 24.8	17	211	12 29 04.5	64	302	4 55.5	135
9 50 05.8	0.124	61	79				10 46 52.8	120	225		
9 55 13.4	0.369	66	64				11 30 37.5	97	290		
10 27 20.6	0.928	68	350				12 28 12.5	68	306		
10 45 57.1	0.856	61	328				12 40 33.5	61	303		
9 49 31.1	0.666	63	45				11 45 31.1	78	285		
10 29 07.4	0.943	65	346				12 29 05.0	64	301		
10 28 29.3	0.946	67	348	10 31 06.6	103	296	12 29 03.1	66	304	5 14.5	135
10 24 53.0	0.889	63	350				12 24 26.7	61	294		
10 53 27.2	0.945	64	319	10 56 38.5	88	310	12 48 10.8	69	317	6 22.5	139
11 07 09.2	0.767	52	312				12 52 10.7	59	304		
11 43 14.7	0.757	48	284				13 16 43.4	87	354		
11 20 57.2	0.894	57	297				13 05 51.1	76	335		
11 10 41.3	0.945	59	305	11 12 48.7	118	355	12 59 32.6	72	326	4 14.9	142
10 29 31.6	0.946	66	346	10 32 29.2	30	226	12 29 37.2	65	302	5 55.3	135
11 16 30.5	0.798	61	296				13 02 38.3	81	341		
9 45 03.1	0.944	56	30	9 48 18.7	65	217	11 44 46.7	62	266	6 31.1	133
10 28 09.7	0.946	66	348	10 31 28.6	44	238	12 28 32.2	65	302	6 37.9	135
10 29 59.9	0.943	65	345				12 29 49.1	64	301		
10 57 09.5	0.945	62	316	11 00 08.3	34	259	12 50 28.7	68	317	5 57.5	140
9 42 03.4	0.944	55	33	9 45 07.9	79	229	11 41 10.3	62	262	6 09.0	133
9 45 04.3	0.944	56	29	9 46 57.1	5	158	11 44 28.9	60	264	3 45.6	133
9 42 16.6	0.939	54	31				11 40 54.1	60	260		
11 56 23.9	0.940	33	287	11 58 17.8	25	280	13 22 23.1	76	337	3 47.7	151
11 57 41.7	0.940	33	286	12 00 27.7	95	353	13 23 20.2	78	340	5 32.0	151
10 09 06.5	0.658	53	359				12 00 00.8	47	263		
10 30 17.3	0.801	60	342				12 26 29.2	57	290		
11 21 00.6	0.636	42	305				12 54 28.4	54	298		
11 17 50.2	0.916	57	299				13 04 00.3	75	331		
9 46 40.5	0.945	56	28	9 49 10.6	20	174	11 46 27.2	61	266	5 00.2	133
9 41 11.3	0.882	53	29				11 38 17.7	57	256		
11 16 28.2	0.944	57	301	11 17 30.8	139	20	13 03 03.3	73	328	2 05.2	143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20°
21°
22°
SOUTH ATLANTIC OCEAN
NAMIB DESERT
ETOSHA PAN
SOUTH-WEST AFRICA (NAMIBIA)
REPUBLIC OF SOUTH AFRICA
Longitude East of Greenwich
Cape Cross
Walvisbaai
Swakopmund
Pelican Pt
Omaruru
Karibib
Okahandja
Otjiwarongo
Outjo
Grootfontein
Tsumeb
Okaukuejo
Namutoni
Halali
Okaharara
Brandenberg
Werftkuelle
Strengel's Dam
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Kamanjab
Otjovasandu
Erongo Mountains
Palgrave Pt
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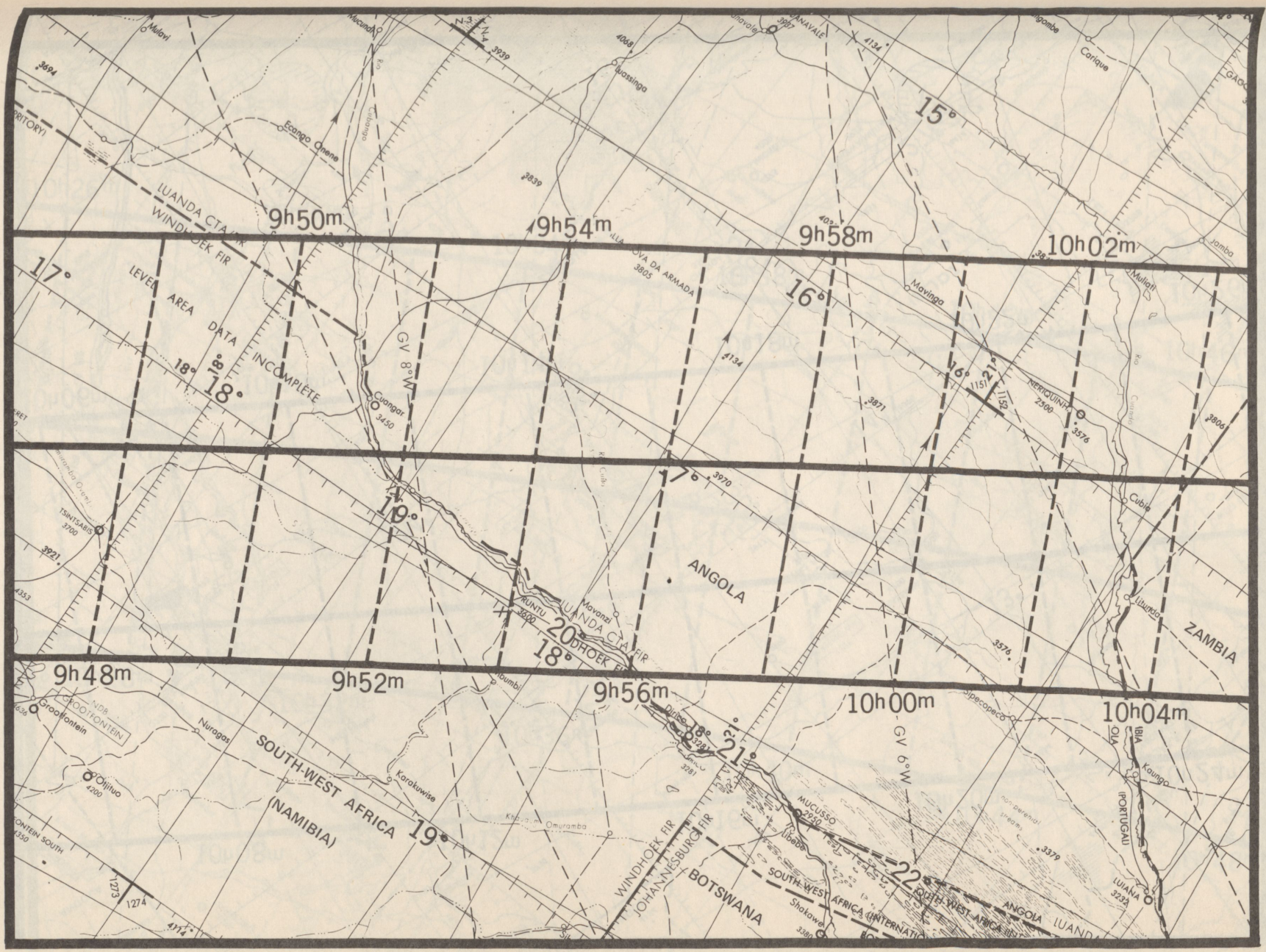
10 fms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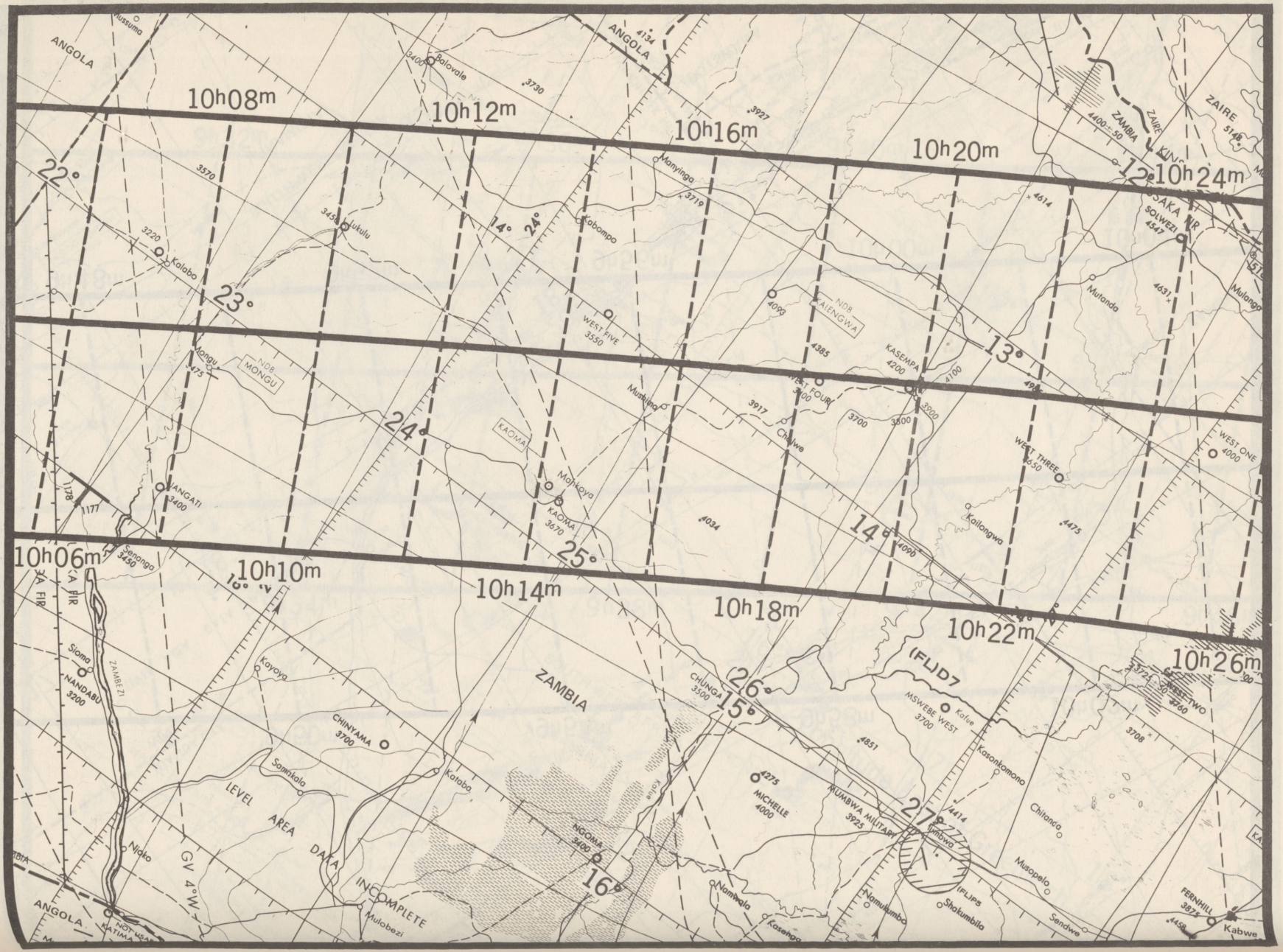
17°
18°
19°
20°
21°
22°
ANGOLA
ZAMBIA
SOUTH-WEST AFRICA (NAMIBIA)
BOTSWANA
LUANDA CTA FIR
WINDHOEK FIR
JOHANNESBURG FIR
LEVEL AREA DATA INCOMPLETE
GV 8°W
GV 6°W
Mulavi
Mucundo
Ecango Onene
Nussinga
Carique
Mavinga
Jamba
Cuangar
Cubiia
Luiana
Kaunga
Grootfontein
Nuragas
Karakuwise
Ohituo
Omuramba
Shakawe
Libebe
Mucusso
Dirico
Mbumbi
Movanzi
Ipeca
Tsintsabis
Kerindungo
Luiana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22°
23°
24°
25°
26°
27°
14° 24°
10°
12°
13°
14°
15°
16°
ANGOLA
ZAMBIA
ZAIRE
ZAMBIA FIR
ANGOLA FIR
LEVEL AREA DATA INCOMPLETE
GV 4°W
NOT USED
KATIMA
Sioma
NANDABU 3200
Senanga 3450
Mongu 3475
NDB MONGU
Kalabo 3220
Lukulu 3450
Mulobezi
Njoko
Kayoyo
Somatala
CHINYAMA 3700
Kataba
NGOMA 3400
Namwala
Kasenga
Palovale 3400
Manyinga 3710
Kabompo
WEST FIVE 3550
NDB KALENGWA
Mushima
Mankoya
KAOMA
KAOMA 3670
Chavuma
WEST FOUR 3700
KASEMPA 4200
Kailongwa
WEST THREE 4450
WEST ONE 4000
WEST TWO 3760
Mutanda
SOLWEZI 4547
SOLWEZI NR
Mulungu
Kafue
MSWEBE WEST 3700
CHUNGA 3500
MICHELLE 4000
MUMBWA MILITARY 3925
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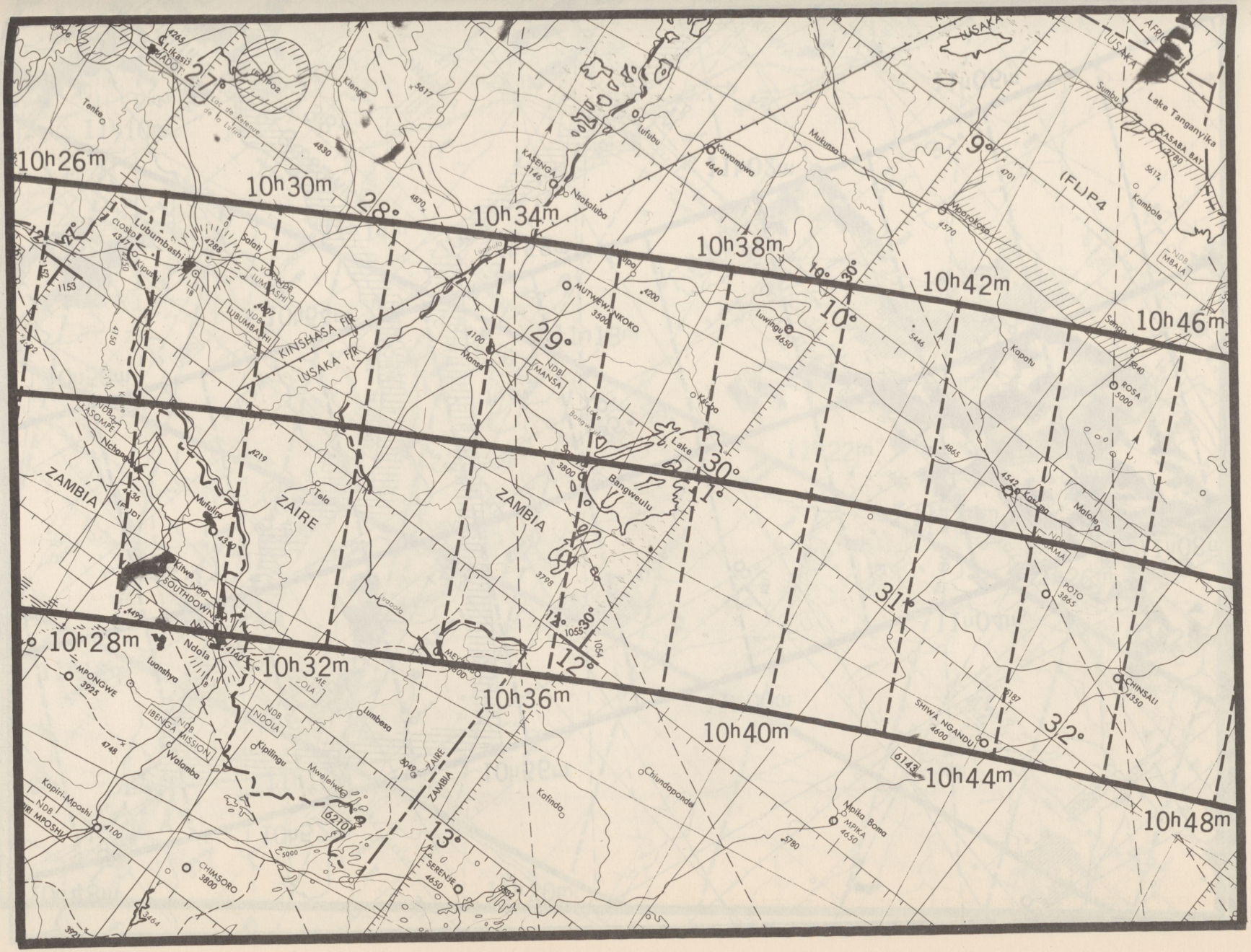
Kabwe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10h48m
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KINSHASA FIR
LUSAKA FIR
ZAMBIA
ZAIRE
Likasi
Lubumbashi
Kipushi
Solwezi
Kasenga
Nsakalubo
Kawambwa
Mutwewa Nkoko
Mansa
Kitwe
Ndola
Mufulira
Tela
Bangweulu
Lake
Kapatu
Rosa
Mpika Boma
Chinsali
Shiwa Ngandu
Lake Tanganyika
Kasaba Bay
Kambole
Mbala
Isoka
Chimsoro
Serenje
Kafindo
Chiundaponde
Mwelelwa
Kipilingu
Walamba
Kapiri-Mposhi
Ibenga Mission
Southdowns
Luanshya
Lumbesa
Mpongwe
Kasama
Poto
Malole
Mukunso
Mporokoso
Luwingu
Kiambi
Tenke
Sumbu
Lufubu
Lusaka
Nusaka
Afri
Kasomfe
Nchanga
Lubumbashi
Solwezi
Likasi
Kipushi
Mansa
Kitwe
Ndola
Mufulira
Kasama
Mbala
Isoka
Serenje
Chinsali
Mpika
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Chimsoro
Shiwa Ngandu
Poto
Rosa
Kapatu
Luwingu
Mporokoso
Mukunso
Sumbu
Kambole
Lake Tanganyika
Kasaba Bay
Kawambwa
Nsakalubo
Kasenga
Lufubu
Kiambi
Tenke
Bangweulu
Lake
Chiundaponde
Kafindo
Mwelelwa
Kipilingu
Walamba
Lumbesa
Luanshya
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Kitwe
Mufulira
Tela
Nchanga
Kasomfe
Southdowns
Ibenga Mission
Mpongwe
Kapiri-Mposhi
Chimsoro
Serenje
Mpika Boma
Chinsali
Shiwa Ngandu
Poto
Kasama
Malole
Rosa
Kapatu
Luwingu
Mutwewa Nkoko
Mansa
Kiambi
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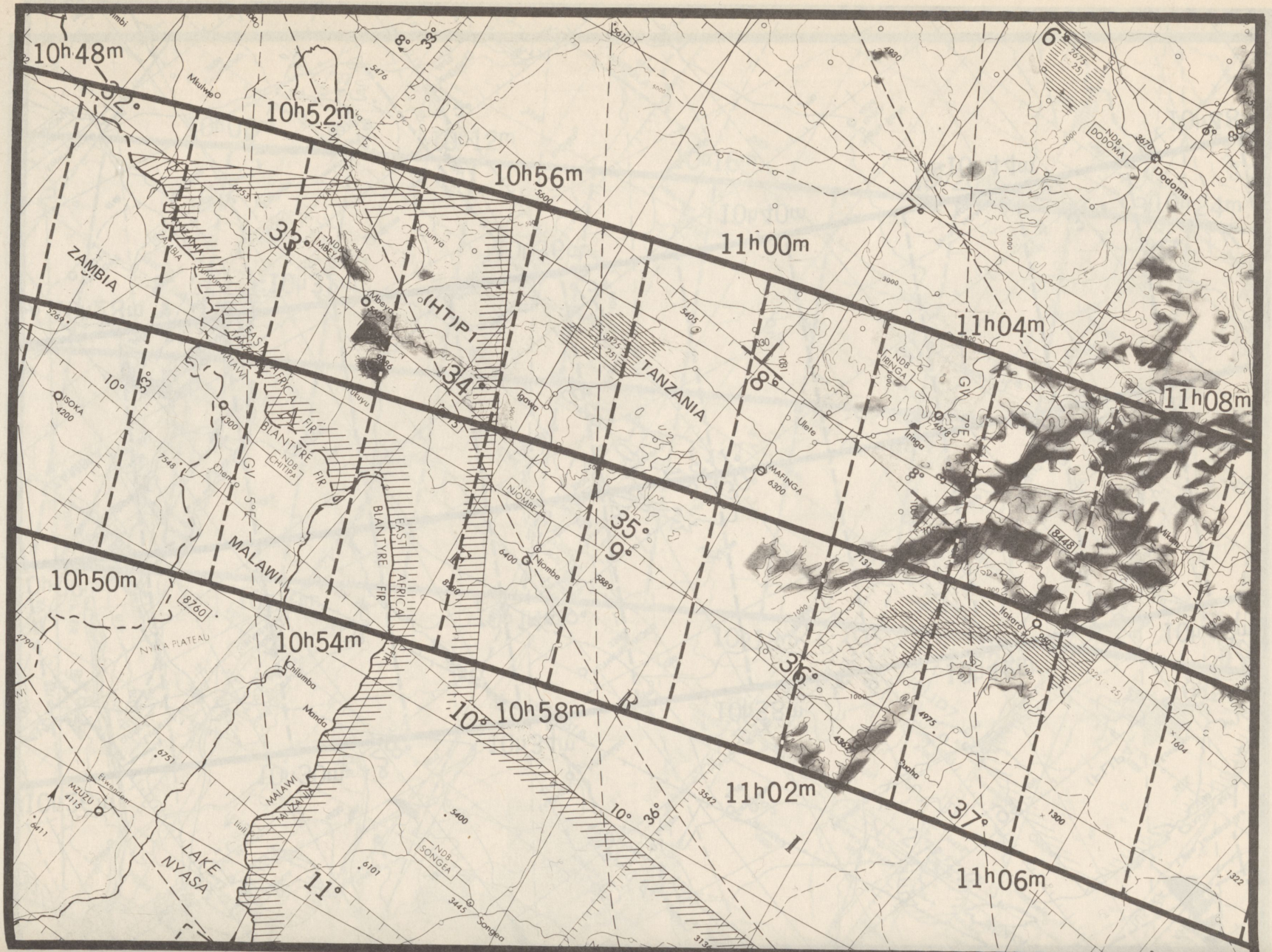
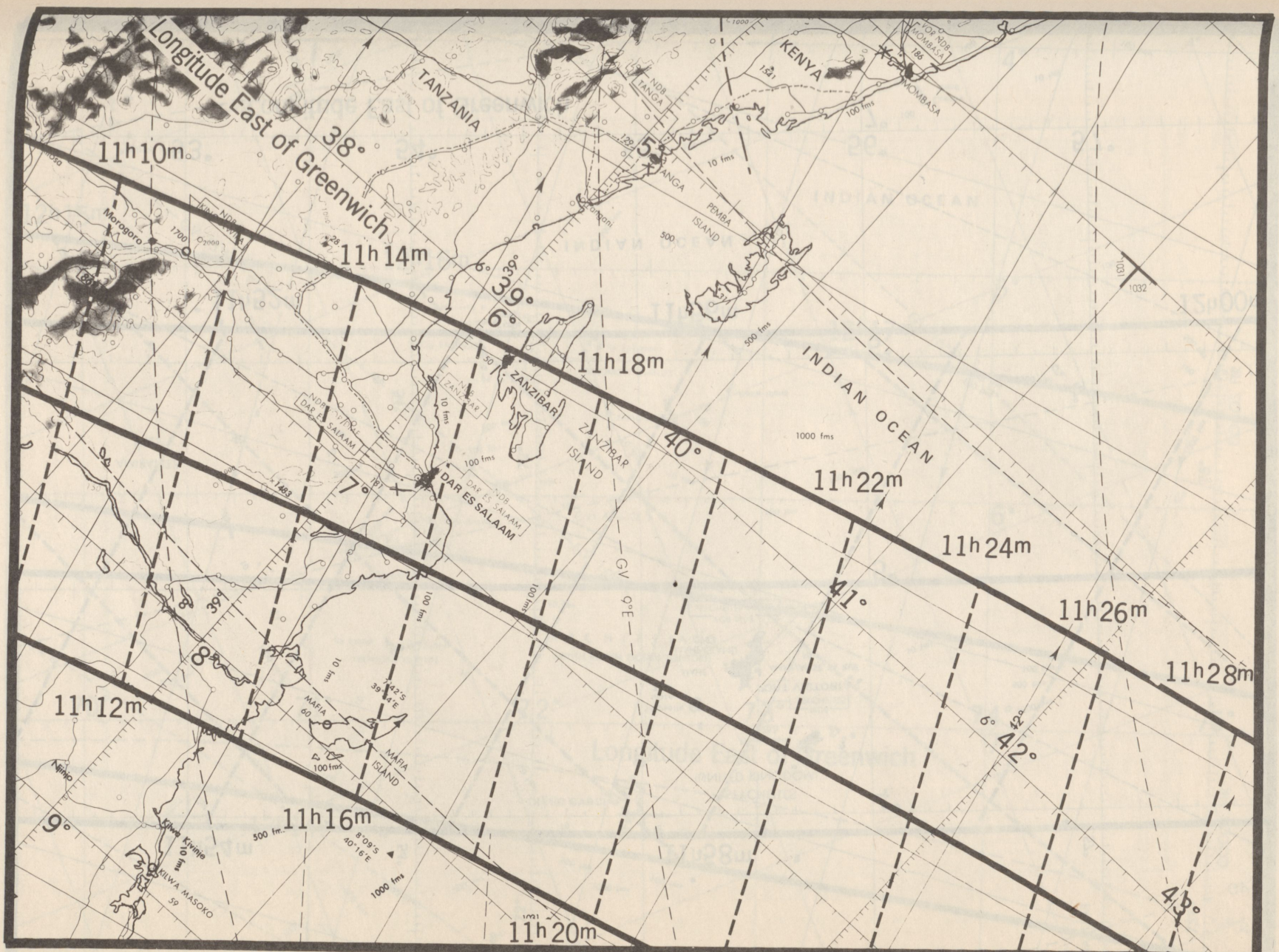
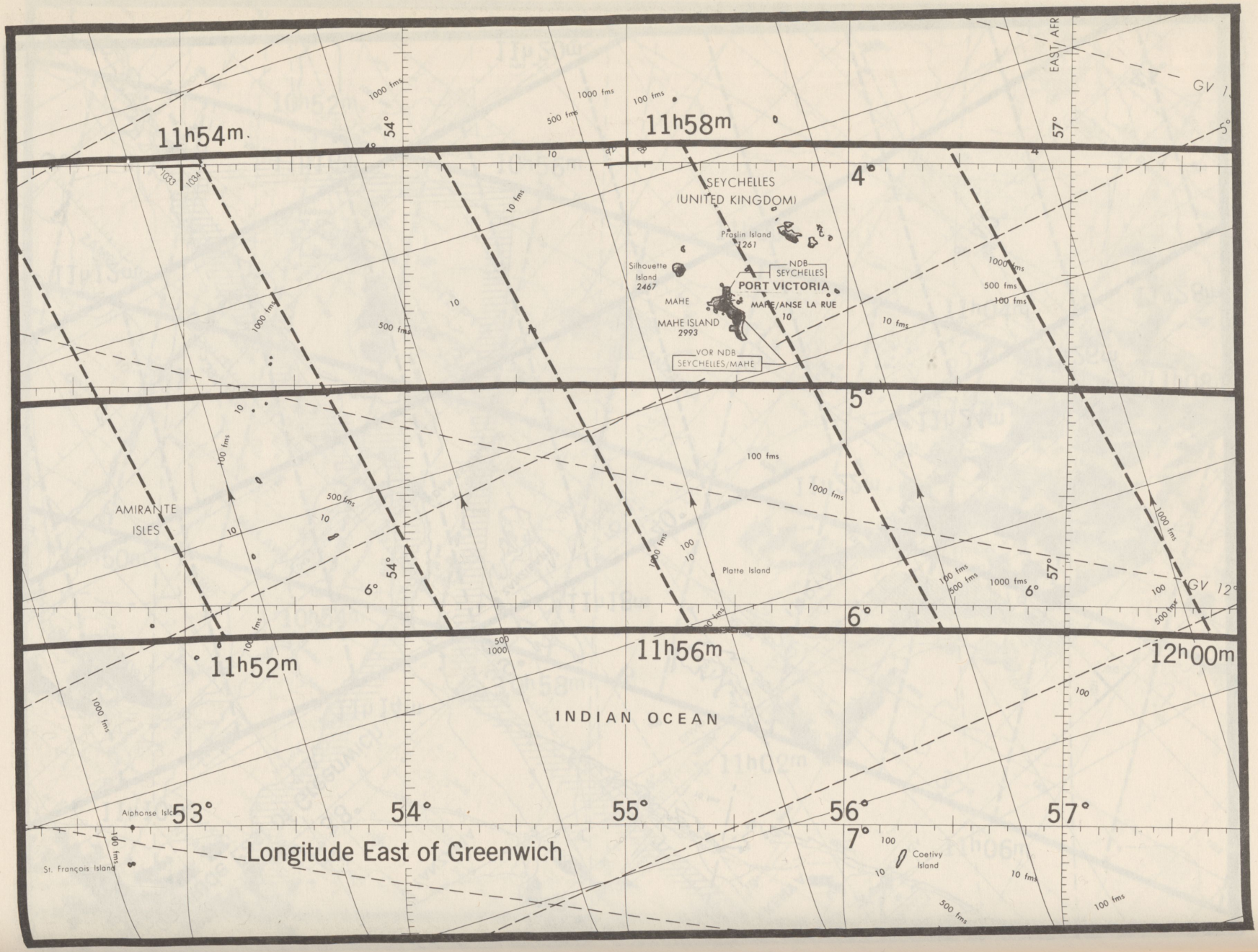
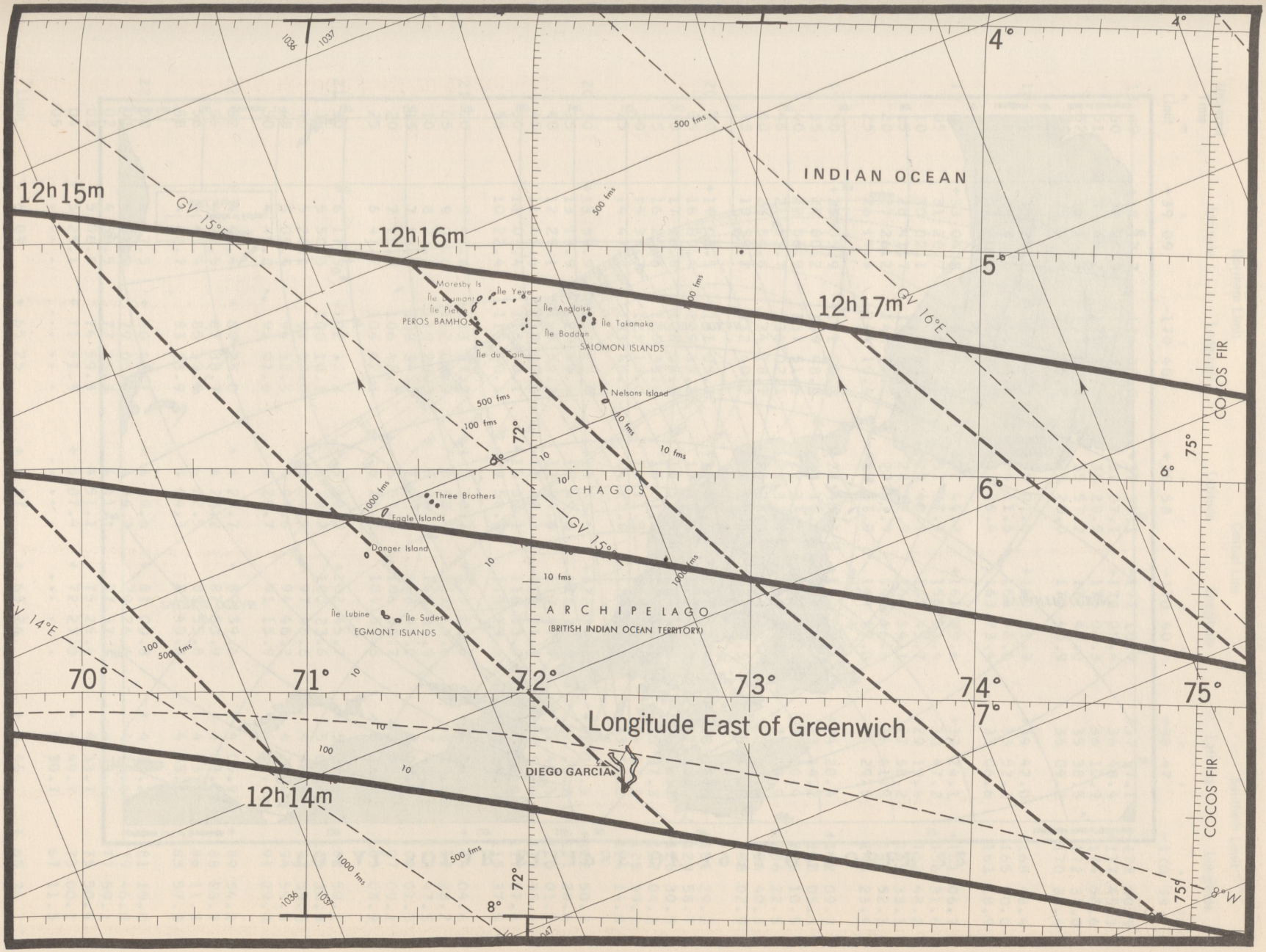
Lufubu

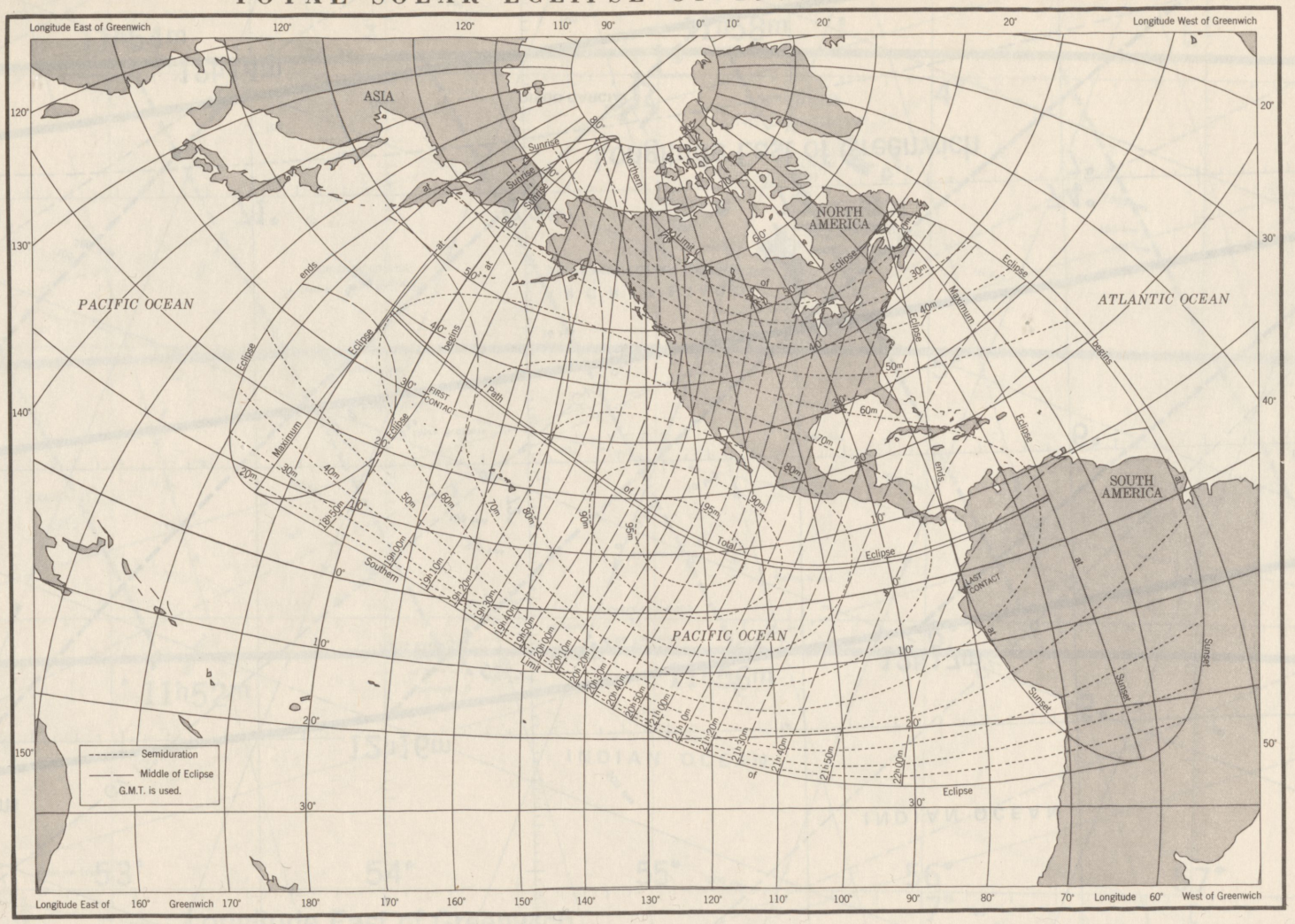

10h48m
10h52m
10h56m
11h00m
11h04m
11h08m
10h50m
10h54m
10h58m
11h02m
11h06m
ZAMBIA
MALAWI
TANZANIA
LAKE NYASA
NYIKA PLATEAU
EAST AFRICA FIR
BLANTYRE FIR
(HT)PT
NDB MBALA
NDB CHITIPA
NDB NJOMBE
NDB IRINGA
NDB DODOMA
NDB SONGEA
ISOKA
Mbeya
Chumvu
Iganjo
Njombe
Ulete
Iringa
MAFINGA
Dodoma
Mlimba
Ifakara
Kilombero
Chilumba
Songea
Mzuzu
Ekwendeni
Manda
Dutha
Chelinda
Mulilwa
Ituyu
Kasito
GV
R
I
32°
33°
34°
35°
36°
37°
8°
9°
10°
11°
5°E
6°
7°E
8°
3660
8760
8448
3670
3445
4975
4200
4115
1604
1322


Longitude East of Greenwich
11h10m
11h12m
11h14m
11h16m
11h18m
11h20m
11h22m
11h24m
11h26m
11h28m
38°
39°
40°
41°
42°
43°
TANZANIA
KENYA
INDIAN OCEAN
ZANZIBAR
ZANZIBAR ISLAND
DAR ES SALAAM
MAFIA ISLAND
MOMBASA
TANGA
PEMBA ISLAND
Morogoro
Kilwa Kivinje
KILWA MASOKO
NAMPULA
100 fms
500 fms
1000 fms


11h54m
11h58m
11h52m
11h56m
12h00m
SEYCHELLES
(UNITED KINGDOM)
Praslin Island
1261
Silhouette
Island
2467
NDB
SEYCHELLES
PORT VICTORIA
MAHE
MAHE/ANSE LA RUE
MAHE ISLAND
2993
VOR NDB
SEYCHELLES/MAHE
AMIRANTE
ISLES
Platte Island
INDIAN OCEAN
Alphonse Isl.
St. François Island
Coetivy
Island
Longitude East of Greenwich
53°
54°
55°
56°
57°
4°
5°
6°
7°
1000 fms
500 fms
100 fms
10 fms
10
100


INDIAN OCEAN
12h15m
12h16m
12h17m
12h14m
GV 15°E
GV 16°E
GV 14°E
Longitude East of Greenwich
DIEGO GARCIA
CHAGOS
ARCHIPELAGO
(BRITISH INDIAN OCEAN TERRITORY)
PEROS BAMHOS
SALOMON ISLANDS
EGMONT ISLANDS
Moresby Is
Île Yeye
Île Anglaise
Île Takamaka
Île Boddam
Île du Coin
Nelsons Island
Three Brothers
Eagle Islands
Danger Island
Île Lubine
Île Sudest
COCOS FIR
500 fms
100 fms
10 fms
1000 fms
1900 fms
70°
71°
72°
73°
74°
75°
4°
5°
6°
7°
8°

TOTAL SOLAR ECLIPSE OF 1977 OCTOBER 12



PATH OF THE TOTAL PHASE

Universal Time	Northern Limit		Central Line		Southern Limit	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
h m	° ′	° ′	° ′	° ′	° ′	° ′
Limit	+39 09	-170 40	+38 58	-170 40	+38 47	-170 39
18 49	+38 17.7	-176 30.0	+37 57.1	-177 18.7	+37 37.1	-178 00.9
50	37 25.9	+178 35.5	37 07.1	+178 09.4	36 48.4	+177 45.3
51	36 48.2	175 27.3	36 29.5	175 08.3	36 10.9	174 50.6
52	36 15.9	173 00.0	35 57.2	172 45.0	35 38.5	172 31.0
53	35 46.9	170 56.2	35 28.0	170 43.9	35 09.2	170 32.4
18 54	+35 20.1	+169 08.1	+35 01.0	+168 57.9	+34 42.0	+168 48.4
56	34 31.0	166 03.8	34 11.6	165 56.6	33 52.2	165 50.0
58	33 46.2	163 28.4	33 26.4	163 23.4	33 06.6	163 18.9
19 00	+33 04.3	+161 12.9	+32 44.2	+161 09.6	+32 24.1	+161 06.7
05	31 28.7	156 31.5	31 07.9	156 31.4	30 47.2	156 31.6
10	30 02.1	152 43.5	29 40.7	152 45.7	29 19.4	152 48.2
15	28 41.7	149 30.1	28 19.9	149 34.1	27 58.2	149 38.3
20	27 26.2	146 41.1	27 03.9	146 46.6	26 41.8	146 52.3
25	26 14.4	144 10.4	25 51.9	144 17.0	25 29.5	144 23.9
19 30	+25 05.9	+141 53.7	+24 43.1	+142 01.4	+24 20.4	+142 09.3
35	24 00.2	139 48.1	23 37.1	139 56.7	23 14.2	140 05.5
40	22 56.9	137 51.5	22 33.6	138 00.9	22 10.4	138 10.5
45	21 55.7	136 02.1	21 32.3	136 12.2	21 08.9	136 22.5
50	20 56.6	134 18.7	20 33.0	134 29.5	20 09.4	134 40.3
55	19 59.2	132 40.2	19 35.5	132 51.5	19 11.8	133 02.9
20 00	+19 03.5	+131 05.7	+18 39.6	+131 17.4	+18 15.8	+131 29.2
05	18 09.4	129 34.3	17 45.4	129 46.5	17 21.5	129 58.7
10	17 16.8	128 05.5	16 52.7	128 18.0	16 28.7	128 30.5
15	16 25.5	126 38.6	16 01.4	126 51.3	15 37.3	127 04.2
20	15 35.7	125 13.0	15 11.5	125 26.0	14 47.3	125 39.1
25	14 47.1	123 48.3	14 22.9	124 01.5	13 58.6	124 14.8
20 30	+13 59.9	+122 23.9	+13 35.6	+122 37.3	+13 11.3	+122 50.7
35	13 13.9	120 59.4	12 49.6	121 12.9	12 25.2	121 26.4
40	12 29.1	119 34.2	12 04.8	119 47.9	11 40.5	120 01.5
45	11 45.6	118 08.0	11 21.3	118 21.7	10 57.0	118 35.4
50	11 03.4	116 40.1	10 39.1	116 53.9	10 14.8	117 07.6
55	10 22.4	115 10.1	9 58.3	115 23.8	9 34.0	115 37.5
21 00	+ 9 42.8	+113 37.2	+ 9 18.7	+113 51.0	+ 8 54.6	+114 04.6
05	9 04.6	112 00.9	8 40.6	112 14.6	8 16.6	112 28.2
10	8 27.8	110 20.3	8 04.0	110 33.9	7 40.1	110 47.5
15	7 52.5	108 34.4	7 28.9	108 48.0	7 05.3	109 01.5
20	7 18.9	106 42.2	6 55.6	106 55.7	6 32.3	107 09.2
25	6 47.2	104 42.1	6 24.2	104 55.6	6 01.2	105 08.9
21 30	+ 6 17.5	+102 32.3	+ 5 55.0	+102 45.7	+ 5 32.3	+102 59.1
35	5 50.3	100 10.1	5 28.2	100 23.6	5 06.0	100 36.9
40	5 26.1	97 32.0	5 04.5	97 45.6	4 42.9	97 59.0
45	5 05.5	94 32.3	4 44.6	94 46.2	4 23.6	94 59.7
50	4 49.8	91 01.6	4 29.7	91 15.9	4 09.6	91 29.9
21 52	+ 4 45.4	+ 89 25.0	+ 4 25.7	+ 89 39.6	+ 4 05.9	+ 89 54.0
54	4 42.5	87 38.7	4 23.2	87 53.9	4 03.8	88 08.7
56	4 41.4	85 39.9	4 22.5	85 55.8	4 03.5	86 11.3
58	4 42.7	83 23.9	4 24.3	83 40.8	4 05.8	83 57.3
22 00	+ 4 47.5	+ 80 42.1	+ 4 29.6	+ 81 00.8	+ 4 11.7	+ 81 19.0
01	4 52.0	79 06.4	4 34.3	79 26.6	4 16.6	79 46.0
02	4 58.5	77 15.3	4 41.1	77 37.6	4 23.6	77 59.1
03	5 08.4	74 59.3	4 51.1	75 25.4	4 33.7	75 50.4
04	+ 5 25.1	+ 71 51.3	+ 5 07.4	+ 72 27.0	+ 4 49.7	73 00.1
05	.. .. .	... .. .	.. .. .	... .. .	5 30.7	67 11.5
Limit	+ 6 09	+ 65 25	+ 5 57	+ 65 26	+ 5 45	+ 65 26

CENTRAL LINE OF TOTAL PHASE

Universal Time	10,000 Feet		20,000 Feet		30,000 Feet		40,000 Feet	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
h m	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
18 49	+37 53.0	-177 39.5	+37 49.0	-177 59.2	+37 45.2	-178 18.0	+37 41.4	-178 36.1
50	37 04.2	+177 57.5	37 01.3	+177 45.8	36 58.5	+177 34.4	36 55.6	+177 23.1
51	36 27.0	174 59.3	36 24.5	174 50.3	36 22.0	174 41.5	36 19.6	174 32.8
52	35 54.9	172 37.5	35 52.6	172 30.1	35 50.4	172 22.7	35 48.1	172 15.4
53	35 25.9	170 37.4	35 23.8	170 31.0	35 21.7	170 24.6	35 19.6	170 18.3
18 54	+34 59.0	+168 52.1	+34 57.0	+168 46.4	+34 55.0	+168 40.8	+34 53.0	+168 35.2
56	34 09.7	165 51.9	34 07.9	165 47.2	34 06.0	165 42.5	34 04.2	165 37.8
58	33 24.6	163 19.3	33 22.9	163 15.3	33 21.2	163 11.3	33 19.4	163 07.3
19 00	+32 42.5	+161 06.0	+32 40.9	+161 02.5	+32 39.2	+160 59.0	+32 37.6	+160 55.5
05	31 06.4	156 28.7	31 04.9	156 26.0	31 03.5	156 23.3	31 02.0	156 20.6
10	29 39.4	152 43.5	29 38.0	152 41.4	29 36.6	152 39.2	29 35.3	152 37.0
15	28 18.6	149 32.3	28 17.4	149 30.5	28 16.1	149 28.7	28 14.8	149 27.0
20	27 02.8	146 45.1	27 01.6	146 43.6	27 00.4	146 42.1	26 59.2	146 40.7
25	25 50.8	144 15.8	25 49.6	144 14.5	25 48.5	144 13.3	25 47.4	144 12.1
19 30	+24 42.0	+142 00.3	+24 41.0	+141 59.3	+24 39.9	+141 58.2	+24 38.8	+141 57.2
35	23 36.1	139 55.8	23 35.1	139 55.0	23 34.1	139 54.1	23 33.1	139 53.2
40	22 32.6	138 00.2	22 31.7	137 59.4	22 30.7	137 58.7	22 29.7	137 58.0
45	21 31.4	136 11.6	21 30.4	136 11.0	21 29.5	136 10.5	21 28.6	136 09.9
50	20 32.1	134 29.0	20 31.2	134 28.5	20 30.3	134 28.0	20 29.4	134 27.6
55	19 34.6	132 51.1	19 33.8	132 50.7	19 32.9	132 50.4	19 32.1	132 50.0
20 00	+18 38.8	+131 17.1	+18 38.0	+131 16.9	+18 37.2	+131 16.6	+18 36.4	+131 16.3
05	17 44.6	129 46.3	17 43.9	129 46.1	17 43.1	129 45.9	17 42.3	129 45.8
10	16 51.9	128 17.9	16 51.2	128 17.8	16 50.4	128 17.7	16 49.7	128 17.6
15	16 00.7	126 51.3	16 00.0	126 51.4	15 59.2	126 51.4	15 58.5	126 51.4
20	15 10.8	125 26.1	15 10.1	125 26.2	15 09.4	125 26.3	15 08.7	125 26.4
25	14 22.2	124 01.7	14 21.5	124 01.8	14 20.9	124 02.0	14 20.2	124 02.2
20 30	+13 34.9	+122 37.5	+13 34.3	+122 37.8	+13 33.7	+122 38.1	+13 33.0	+122 38.3
35	12 48.9	121 13.2	12 48.3	121 13.6	12 47.7	121 13.9	12 47.1	121 14.3
40	12 04.2	119 48.3	12 03.6	119 48.7	12 03.0	119 49.1	12 02.4	119 49.6
45	11 20.8	118 22.2	11 20.2	118 22.7	11 19.6	118 23.2	11 19.0	118 23.7
50	10 38.6	116 54.5	10 38.0	116 55.1	10 37.5	116 55.7	10 36.9	116 56.3
55	9 57.7	115 24.5	9 57.2	115 25.2	9 56.6	115 25.9	9 56.1	115 26.6
21 00	+ 9 18.2	+113 51.7	+ 9 17.7	+113 52.5	+ 9 17.2	+113 53.3	+ 9 16.6	+113 54.1
05	8 40.1	112 15.5	8 39.6	112 16.4	8 39.1	112 17.3	8 38.6	112 18.2
10	8 03.5	110 34.9	8 03.0	110 35.9	8 02.5	110 36.9	8 02.0	110 37.9
15	7 28.4	108 49.1	7 28.0	108 50.3	7 27.5	108 51.4	7 27.0	108 52.5
20	6 55.1	106 57.0	6 54.7	106 58.2	6 54.2	106 59.5	6 53.7	107 00.7
25	6 23.7	104 57.0	6 23.3	104 58.4	6 22.8	104 59.8	6 22.3	105 01.2
21 30	+ 5 54.5	+102 47.3	+ 5 54.0	+102 48.9	+ 5 53.5	+102 50.5	+ 5 53.0	+102 52.1
35	5 27.7	100 25.4	5 27.3	100 27.2	5 26.8	100 29.0	5 26.3	100 30.8
40	5 04.0	97 47.7	5 03.5	97 49.7	5 03.0	97 51.8	5 02.5	97 53.8
45	4 44.0	94 48.6	4 43.5	94 51.0	4 43.0	94 53.3	4 42.5	94 55.7
50	4 29.2	91 18.8	4 28.6	91 21.6	4 28.0	91 24.5	4 27.4	91 27.4
21 52	+ 4 25.1	+ 89 42.8	+ 4 24.5	+ 89 45.9	+ 4 23.9	+ 89 49.0	+ 4 23.3	+ 89 52.1
54	4 22.5	87 57.3	4 21.9	88 00.8	4 21.3	88 04.2	4 20.6	88 07.7
56	4 21.8	85 59.7	4 21.1	86 03.5	4 20.4	86 07.4	4 19.7	86 11.2
58	4 23.5	83 45.3	4 22.7	83 49.7	4 22.0	83 54.2	4 21.2	83 58.6
22 00	+ 4 28.8	+ 81 06.2	+ 4 27.9	+ 81 11.5	+ 4 27.0	+ 81 16.8	+ 4 26.1	+ 81 22.1
01	4 33.4	79 32.6	4 32.4	79 38.6	4 31.4	79 44.6	4 30.5	79 50.5
02	4 40.0	77 44.7	4 38.9	77 51.7	4 37.8	77 58.6	4 36.7	78 05.5
03	4 49.7	75 34.2	4 48.4	75 42.8	4 47.1	75 51.3	4 45.8	75 59.7
04	+ 5 05.5	+ 72 39.6	5 03.7	72 51.9	5 01.9	73 03.8	5 00.2	73 15.4
05	.. .. .	... .. .	+ 5 44.5	+ 66 52.6	+ 5 37.5	+ 67 42.9	+ 5 32.5	+ 68 19.1

DURATION OF TOTAL PHASE AND WIDTH OF PATH ON CENTRAL LINE

Universal Time	10,000 Feet		20,000 Feet		30,000 Feet		40,000 Feet	
	Duration	Width of Path	Duration	Width of Path	Duration	Width of Path	Duration	Width of Path
h m	m s	mi	m s	mi	m s	mi	m s	mi
18 49	0 43.6	29	0 44.0	29	0 44.4	29	0 44.8	29
50	0 49.3	31	0 49.5	31	0 49.8	31	0 50.0	31
51	0 53.4	33	0 53.6	33	0 53.8	33	0 54.0	33
52	0 56.9	34	0 57.1	34	0 57.3	34	0 57.5	34
53	1 00.0	35	1 00.2	35	1 00.4	35	1 00.5	35
18 54	1 02.9	36	1 03.0	36	1 03.2	37	1 03.3	37
56	1 08.0	38	1 08.2	38	1 08.3	38	1 08.4	38
58	1 12.7	40	1 12.8	40	1 12.9	40	1 13.1	40
19 00	1 16.9	41	1 17.1	41	1 17.2	41	1 17.3	41
05	1 26.6	44	1 26.7	44	1 26.8	44	1 26.9	44
10	1 35.1	47	1 35.2	47	1 35.3	47	1 35.4	47
15	1 42.8	48	1 42.9	48	1 43.0	48	1 43.1	48
20	1 49.9	51	1 50.0	51	1 50.1	51	1 50.2	51
25	1 56.4	52	1 56.5	52	1 56.6	52	1 56.7	52
19 30	2 02.4	54	2 02.5	53	2 02.6	53	2 02.7	53
35	2 07.9	55	2 08.0	55	2 08.1	55	2 08.2	55
40	2 13.0	56	2 13.1	56	2 13.2	56	2 13.3	56
45	2 17.5	57	2 17.6	57	2 17.7	57	2 17.8	57
50	2 21.6	58	2 21.8	58	2 21.8	58	2 22.0	58
55	2 25.3	59	2 25.4	60	2 25.5	60	2 25.6	60
20 00	2 28.5	60	2 28.6	60	2 28.7	60	2 28.8	60
05	2 31.2	61	2 31.3	61	2 31.4	61	2 31.6	61
10	2 33.4	61	2 33.5	61	2 33.7	61	2 33.8	61
15	2 35.2	62	2 35.3	62	2 35.4	62	2 35.5	62
20	2 36.5	63	2 36.6	63	2 36.7	63	2 36.8	63
25	2 37.3	63	2 37.4	63	2 37.5	63	2 37.6	63
20 30	2 37.5	63	2 37.6	63	2 37.7	64	2 37.8	64
35	2 37.3	63	2 37.4	63	2 37.5	64	2 37.6	64
40	2 36.5	63	2 36.6	63	2 36.7	64	2 36.8	64
45	2 35.2	63	2 35.3	63	2 35.5	64	2 35.6	64
50	2 33.4	63	2 33.5	63	2 33.7	64	2 33.8	64
55	2 31.1	63	2 31.2	63	2 31.4	64	2 31.5	64
21 00	2 28.3	63	2 28.4	63	2 28.5	63	2 28.6	63
05	2 24.9	63	2 25.0	63	2 25.2	63	2 25.3	63
10	2 21.0	62	2 21.1	62	2 21.3	62	2 21.4	62
15	2 16.6	61	2 16.7	61	2 16.9	61	2 17.0	61
20	2 11.7	59	2 11.8	60	2 11.9	60	2 12.0	60
25	2 06.2	59	2 06.3	59	2 06.4	59	2 06.6	59
21 30	2 00.2	57	2 00.3	57	2 00.4	57	2 00.5	57
35	1 53.5	56	1 53.6	56	1 53.7	56	1 53.8	56
40	1 46.2	53	1 46.3	53	1 46.4	53	1 46.5	53
45	1 38.2	51	1 38.3	51	1 38.4	51	1 38.5	51
50	1 29.2	48	1 29.3	48	1 29.5	48	1 29.6	48
21 52	1 25.3	46	1 25.4	46	1 25.5	47	1 25.7	47
54	1 21.1	45	1 21.2	45	1 21.4	45	1 21.5	45
56	1 16.6	44	1 16.8	44	1 16.9	44	1 17.0	44
58	1 11.7	41	1 11.9	41	1 12.0	41	1 12.2	41
22 00	1 06.2	39	1 06.4	40	1 06.6	40	1 06.7	40
01	1 03.2	38	1 03.4	38	1 03.5	38	1 03.7	38
02	0 59.8	36	1 00.0	36	1 00.2	37	1 00.4	37
03	0 55.8	35	0 56.1	35	0 56.3	35	0 56.5	35
04	0 50.9	33	0 51.2	33	0 51.5	33	0 51.8	33
05	. .. .	...	0 42.0	29	0 43.1	29	0 44.0	29

CENTRAL LINE OF TOTAL PHASE

Universal Time	80 Km		100 Km		200 Km		300 Km	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
h m	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
18 44	.. .. .	... .. .	.. .. .	... .. .	.. .. .	... .. .	+36 34.1	+179 42.6
45	.. .. .	... .. .	.. .. .	... .. .	+37 47.7	−174 35.5	35 52.5	176 07.6
18 46	.. .. .	... .. .	.. .. .	... .. .	+36 43.9	+179 07.5	+35 18.8	+173 30.0
48	+37 15.6	−179 51.9	+36 54.9	+178 36.8	35 30.8	173 14.5	34 22.0	169 30.6
18 50	+35 58.8	+173 51.7	+35 43.6	+172 59.5	+34 34.4	+169 19.8	+33 32.9	+166 24.6
55	33 46.8	165 15.8	33 35.2	164 46.5	32 39.4	162 32.1	31 47.4	160 34.0
19 00	+32 02.0	+159 40.5	+31 51.7	+159 19.5	+31 02.4	+157 40.5	+30 15.7	+156 10.6
05	30 29.7	155 22.8	30 20.4	155 06.4	29 35.3	153 48.3	28 52.4	152 36.3
10	29 05.5	151 50.5	28 56.9	151 37.2	28 15.0	150 33.5	27 35.0	149 34.0
15	27 47.0	148 48.5	27 39.0	148 37.5	26 59.8	147 44.6	26 22.2	146 54.7
20	26 33.0	146 08.5	26 25.4	145 59.3	25 48.5	145 14.7	25 13.0	144 32.6
25	25 22.7	143 45.1	25 15.5	143 37.3	24 40.5	142 59.6	24 06.9	142 23.9
19 30	+24 15.4	+141 34.5	+24 08.6	+141 27.9	+23 35.3	+140 56.1	+23 03.3	+140 25.8
35	23 10.7	139 34.1	23 04.3	139 28.6	22 32.6	139 01.8	22 02.1	138 36.3
40	22 08.5	137 42.1	22 02.3	137 37.5	21 32.1	137 15.2	21 03.0	136 53.8
45	21 08.3	135 56.8	21 02.4	135 53.1	20 33.5	135 34.8	20 05.7	135 17.2
50	20 10.0	134 17.1	20 04.4	134 14.1	19 36.8	133 59.4	19 10.1	133 45.3
55	19 13.5	132 42.0	19 08.1	132 39.7	18 41.7	132 28.3	18 16.1	132 17.4
20 00	+18 18.6	+131 10.5	+18 13.4	+131 08.9	+17 48.1	+131 00.6	+17 23.6	+130 52.7
05	17 25.2	129 42.1	17 20.3	129 41.0	16 55.9	129 35.7	16 32.4	129 30.7
10	16 33.3	128 15.9	16 28.5	128 15.4	16 05.2	128 13.0	15 42.6	128 10.7
15	15 42.8	126 51.6	15 38.2	126 51.6	15 15.8	126 51.9	14 54.0	126 52.2
20	14 53.6	125 28.5	14 49.2	125 29.1	14 27.6	125 32.0	14 06.7	125 34.8
25	14 05.6	124 06.1	14 01.4	124 07.2	13 40.6	124 12.8	13 20.6	124 18.1
20 30	+13 19.0	+122 44.0	+13 14.9	+122 45.7	+12 54.9	+122 53.8	+12 35.6	+123 01.6
35	12 33.6	121 21.8	12 29.6	121 24.0	12 10.4	121 34.7	11 51.7	121 45.0
40	11 49.4	119 58.9	11 45.6	120 01.7	11 27.0	120 14.9	11 09.0	120 27.8
45	11 06.4	118 35.0	11 02.8	118 38.2	10 44.8	118 54.2	10 27.4	119 09.6
50	10 24.7	117 09.4	10 21.2	117 13.2	10 03.8	117 31.9	9 47.0	117 49.9
55	9 44.3	115 41.7	9 40.8	115 46.1	9 24.0	116 07.6	9 07.7	116 28.4
21 00	+ 9 05.2	+114 11.4	+ 9 01.8	+114 16.4	+ 8 45.5	+114 40.9	+ 8 29.6	+115 04.5
05	8 27.4	112 37.6	8 24.1	112 43.3	8 08.2	113 10.9	7 52.8	113 37.6
10	7 51.1	110 59.8	7 47.9	111 06.2	7 32.3	111 37.2	7 17.3	112 07.0
15	7 16.3	109 17.0	7 13.1	109 24.1	6 57.9	109 58.8	6 43.2	110 32.2
20	6 43.1	107 28.2	6 40.0	107 36.1	6 25.0	108 14.8	6 10.6	108 52.1
25	6 11.8	105 31.9	6 08.7	105 40.8	5 53.9	106 24.1	5 39.5	107 05.6
21 30	+ 5 42.5	+103 26.6	+ 5 39.5	+103 36.5	+ 5 24.6	+104 25.1	+ 5 10.3	+105 11.4
35	5 15.6	101 09.8	5 12.5	101 21.1	4 57.5	102 15.7	4 43.1	103 07.8
40	4 51.5	98 38.4	4 48.4	98 51.2	4 33.0	99 53.3	4 18.3	100 52.2
45	4 31.0	95 47.5	4 27.6	96 02.3	4 11.6	97 13.8	3 56.4	98 21.2
50	4 15.0	92 29.1	4 11.4	92 46.8	3 54.2	94 11.0	3 38.1	95 29.7
55	4 05.7	88 28.8	4 01.6	88 50.7	3 42.4	90 34.0	3 24.5	92 08.8
22 00	+ 4 07.7	+ 83 12.2	+ 4 02.7	+ 83 42.3	+ 3 39.2	+ 86 00.2	+ 3 18.2	+ 88 01.7
02	4 14.6	80 23.9	4 08.6	81 00.5	3 41.9	83 43.6	3 18.7	86 02.4
04	4 28.7	76 43.3	4 21.1	77 32.9	3 48.5	80 59.8	3 21.9	83 44.7
06	+ 5 06.1	+ 70 12.9	+ 4 50.3	+ 72 02.7	4 01.9	77 27.2	3 29.1	80 58.7
22 07	.. .. .	... .. .	.. .. .	... .. .	+ 4 13.8	+ 75 03.4	+ 3 35.1	+ 79 18.8
08	.. .. .	... .. .	.. .. .	... .. .	+ 4 35.0	+ 71 30.9	3 43.7	77 20.3
09	.. .. .	... .. .	.. .. .	... .. .	.. .. .	... .. .	3 56.8	74 48.9
10	.. .. .	... .. .	.. .. .	... .. .	.. .. .	... .. .	+ 4 22.2	+ 70 46.5

DURATION OF TOTAL PHASE AND WIDTH OF PATH ON CENTRAL LINE

Universal Time	80 Km		100 Km		200 Km		300 Km	
	Duration	Width of Path	Duration	Width of Path	Duration	Width of Path	Duration	Width of Path
h m	m s	*mi*	m s	*mi*	m s	*mi*	m s	*mi*
18 44	. .. .	...	. .. .	...	. .. .	...	0 46.1	29
45	. .. .	...	. .. .	...	0 39.2	26	0 51.2	32
18 46	. .. .	...	. .. .	...	0 47.2	30	0 55.2	33
48	0 46.2	30	0 48.2	31	0 55.7	34	1 01.7	36
18 50	0 55.0	33	0 56.2	34	1 02.1	36	1 07.3	37
55	1 09.2	39	1 10.1	39	1 14.7	40	1 19.0	41
19 00	1 20.1	42	1 20.9	42	1 25.0	43	1 29.0	44
05	1 29.5	45	1 30.3	45	1 34.1	46	1 37.9	46
10	1 37.9	47	1 38.7	47	1 42.3	48	1 46.0	49
15	1 45.6	49	1 46.3	49	1 49.9	50	1 53.5	51
20	1 52.6	51	1 53.3	52	1 56.9	52	2 00.4	52
25	1 59.1	53	1 59.8	52	2 03.3	53	2 06.9	54
19 30	2 05.1	54	2 05.8	54	2 09.3	55	2 12.9	56
35	2 10.6	55	2 11.3	56	2 14.8	56	2 18.4	56
40	2 15.7	56	2 16.3	56	2 19.9	57	2 23.5	58
45	2 20.2	58	2 20.9	58	2 24.5	58	2 28.1	59
50	2 24.3	59	2 25.1	59	2 28.6	60	2 32.2	60
55	2 28.0	59	2 28.7	60	2 32.3	60	2 36.0	61
20 00	2 31.2	60	2 31.9	60	2 35.5	61	2 39.2	61
05	2 34.0	61	2 34.7	61	2 38.3	62	2 42.0	62
10	2 36.2	62	2 36.9	62	2 40.6	62	2 44.3	63
15	2 38.0	63	2 38.7	63	2 42.4	63	2 46.1	64
20	2 39.3	63	2 40.0	63	2 43.6	64	2 47.4	64
25	2 40.0	63	2 40.8	64	2 44.5	64	2 48.2	65
20 30	2 40.3	63	2 41.0	64	2 44.8	65	2 48.5	65
35	2 40.1	64	2 40.8	64	2 44.5	65	2 48.3	65
40	2 39.3	64	2 40.0	64	2 43.8	65	2 47.6	66
45	2 38.0	64	2 38.8	64	2 42.5	65	2 46.3	66
50	2 36.2	64	2 37.0	64	2 40.7	65	2 44.5	66
55	2 33.9	63	2 34.7	64	2 38.4	65	2 42.3	65
21 00	2 31.1	63	2 31.9	64	2 35.6	64	2 39.4	65
05	2 27.8	63	2 28.5	63	2 32.2	64	2 36.1	64
10	2 23.9	63	2 24.6	62	2 28.3	63	2 32.2	64
15	2 19.5	61	2 20.2	61	2 23.9	62	2 27.7	63
20	2 14.5	60	2 15.3	60	2 19.0	61	2 22.8	61
25	2 09.1	59	2 09.8	60	2 13.5	60	2 17.4	61
21 30	2 03.0	58	2 03.7	58	2 07.5	59	2 11.3	59
35	1 56.4	56	1 57.2	56	2 00.9	57	2 04.8	58
40	1 49.1	54	1 49.9	54	1 53.8	55	1 57.6	56
45	1 41.2	51	1 42.0	52	1 45.9	52	1 49.9	54
50	1 32.4	49	1 33.2	49	1 37.3	50	1 41.4	51
55	1 22.4	45	1 23.3	46	1 27.7	47	1 32.0	48
22 00	1 10.4	41	1 11.5	41	1 16.5	43	1 21.3	45
02	1 04.6	39	1 05.8	39	1 11.4	41	1 16.5	43
04	0 57.6	35	0 59.1	36	1 05.5	38	1 11.2	41
06	0 46.6	30	0 49.4	32	0 58.5	36	1 05.2	38
22 07	. .. .	...	. .. .	...	0 54.2	34	1 01.8	37
08	. .. .	...	. .. .	...	0 48.1	31	0 57.9	36
09	. .. .	...	. .. .	...	. .. .	...	0 53.3	33
10	. .. .	...	. .. .	...	. .. .	...	0 46.4	31

LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

Central Line			First Contact			Second Contact		
Universal Time	Latitude	Longitude	Universal Time	P	V	Universal Time	P	V
h m	° ′	° ′	h m s	°	°	h m s	°	°
18 49	+37 57.1	-177 18.7	•• •• •• •	•••	•••	18 48 37.0	111	162
50	37 07.1	+178 09.4	•• •• •• •	•••	•••	18 49 34.0	112	162
51	36 29.5	175 08.3	•• •• •• •	•••	•••	18 50 31.9	112	162
52	35 57.2	172 45.0	17 49 03.1	291	345	18 51 30.1	112	162
53	35 28.0	170 43.9	17 49 08.5	292	345	18 52 28.6	113	163
18 54	+35 01.0	+168 57.9	17 49 18.7	292	346	18 53 27.1	113	163
56	34 11.6	165 56.6	17 49 48.7	292	346	18 55 24.5	114	163
58	33 26.4	163 23.4	17 50 27.5	293	347	18 57 22.1	114	163
19 00	+32 44.2	+161 09.6	17 51 12.5	293	347	18 59 19.9	114	163
05	31 07.9	156 31.4	17 53 23.4	294	348	19 04 15.1	115	162
10	29 40.7	152 45.7	17 55 52.2	295	349	19 09 10.7	116	162
15	28 19.9	149 34.1	17 58 33.4	296	350	19 14 06.8	117	161
20	27 03.9	146 46.6	18 01 24.1	296	350	19 19 03.2	117	159
25	25 51.9	144 17.0	18 04 22.7	297	350	19 23 59.9	118	158
19 30	+24 43.1	+142 01.4	18 07 28.3	297	350	19 28 56.9	118	156
35	23 37.1	139 56.7	18 10 40.2	298	350	19 33 54.1	119	154
40	22 33.6	138 00.9	18 13 58.0	298	350	19 38 51.5	119	151
45	21 32.3	136 12.2	18 17 21.5	298	350	19 43 49.2	119	149
50	20 33.0	134 29.5	18 20 50.6	299	350	19 48 47.1	119	145
55	19 35.5	132 51.5	18 24 25.4	299	349	19 53 45.2	119	141
20 00	+18 39.6	+131 17.4	18 28 05.9	299	348	19 58 43.6	119	137
05	17 45.4	129 46.5	18 31 52.3	299	347	20 03 42.2	119	131
10	16 52.7	128 18.0	18 35 44.6	300	346	20 08 41.1	119	126
15	16 01.4	126 51.3	18 39 43.4	300	344	20 13 40.2	119	119
20	15 11.5	125 26.0	18 43 48.7	300	342	20 18 39.6	119	113
25	14 22.9	124 01.5	18 48 01.1	300	340	20 23 39.2	119	105
20 30	+13 35.6	+122 37.3	18 52 20.9	300	337	20 28 39.1	119	98
35	12 49.6	121 12.9	18 56 48.6	300	333	20 33 39.2	118	91
40	12 04.8	119 47.9	19 01 24.8	299	329	20 38 39.5	118	84
45	11 21.3	118 21.7	19 06 09.9	299	323	20 43 40.2	117	77
50	10 39.1	116 53.9	19 11 04.6	299	316	20 48 41.1	117	71
55	9 58.3	115 23.8	19 16 09.7	298	308	20 53 42.3	116	65
21 00	+ 9 18.7	+113 51.0	19 21 25.7	298	298	20 58 43.7	116	60
05	8 40.6	112 14.6	19 26 53.6	298	287	21 03 45.4	115	56
10	8 04.0	110 33.9	19 32 34.1	297	276	21 08 47.4	115	51
15	7 28.9	108 48.0	19 38 28.3	296	265	21 13 49.6	114	48
20	6 55.6	106 55.7	19 44 37.2	296	254	21 18 52.1	113	44
25	6 24.2	104 55.6	19 51 01.7	295	245	21 23 55.0	112	41
21 30	+ 5 55.0	+102 45.7	19 57 43.3	294	238	21 28 58.0	111	38
35	5 28.2	100 23.6	20 04 43.4	293	231	21 34 01.4	111	35
40	5 04.5	97 45.6	20 12 04.2	292	225	21 39 05.1	110	32
45	4 44.6	94 46.2	20 19 48.4	291	220	21 44 09.2	109	30
50	4 29.7	91 15.9	20 28 00.9	290	216	21 49 13.7	108	27
21 52	+ 4 25.7	+ 89 39.6	20 31 27.7	290	214	21 51 15.7	107	26
54	4 23.2	87 53.9	20 35 01.3	289	213	21 53 17.9	107	26
56	4 22.5	85 55.8	20 38 43.4	288	211	21 55 20.2	107	25
58	4 24.3	83 40.8	20 42 36.4	288	210	21 57 22.6	106	24
22 00	+ 4 29.6	+ 81 00.8	20 46 44.7	287	208	21 59 25.4	106	23
01	4 34.3	79 26.6	20 48 57.3	287	207	22 00 27.0	105	22
02	4 41.1	77 37.6	20 51 18.4	286	206	22 01 28.7	105	22
03	4 51.1	75 25.4	20 53 52.6	286	205	22 02 30.7	105	21
04	+ 5 07.4	+ 72 27.0	20 56 52.8	285	204	22 03 33.3	104	20

LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

Maximum Eclipse						Third Contact				Fourth Contact				Duration	Width of Path
Universal Time			Magnitude	Sun's Alt.	Sun's Az.	Universal Time			P	V	Universal Time			P	V		
h	m	s		°	°	h	m	s	°	°	h	m	s	°	°	m s	mi
18	49	00.0	1.013	5	104	18	49	23.0	291	342	19	53	45.8	112	158	0 46.0	29
18	50	00.0	1.014	9	107	18	50	26.0	292	342	19	56	56.2	113	158	0 52.0	31
18	51	00.0	1.015	12	109	18	51	28.1	292	342	19	59	29.8	113	157	0 56.2	32
18	52	00.0	1.015	14	111	18	52	29.9	292	342	20	01	47.9	113	157	0 59.8	34
18	53	00.0	1.016	16	112	18	53	31.4	293	342	20	03	56.8	114	156	1 02.8	35
18	54	00.0	1.016	18	113	18	54	32.9	293	343	20	05	59.3	114	156	1 05.8	36
18	56	00.0	1.017	21	115	18	56	35.5	294	343	20	09	51.2	115	154	1 11.0	38
18	58	00.0	1.018	23	117	18	58	37.9	294	343	20	13	30.8	115	153	1 15.8	40
19	00	00.0	1.019	26	119	19	00	40.1	294	343	20	17	01.3	116	152	1 20.2	41
19	05	00.0	1.020	31	123	19	05	44.9	295	342	20	25	19.7	116	149	1 29.8	44
19	10	00.0	1.021	35	126	19	10	49.3	296	341	20	33	09.0	117	145	1 38.6	47
19	15	00.0	1.022	39	129	19	15	53.2	297	340	20	40	36.4	118	140	1 46.4	48
19	20	00.0	1.023	43	132	19	20	56.8	297	339	20	47	45.3	118	135	1 53.6	51
19	25	00.0	1.024	46	135	19	26	00.1	298	338	20	54	38.1	118	130	2 00.2	52
19	30	00.0	1.024	49	138	19	31	03.1	298	336	21	01	16.3	119	124	2 06.2	54
19	35	00.0	1.025	52	142	19	36	05.9	299	333	21	07	40.5	119	118	2 11.8	55
19	40	00.0	1.025	54	145	19	41	08.5	299	331	21	13	52.0	119	112	2 17.0	56
19	45	00.0	1.026	57	149	19	46	10.8	299	328	21	19	51.1	119	105	2 21.6	57
19	50	00.0	1.026	59	153	19	51	12.9	299	324	21	25	38.3	119	99	2 25.8	58
19	55	00.0	1.027	61	158	19	56	14.8	299	320	21	31	14.4	119	93	2 29.6	59
20	00	00.0	1.027	63	163	20	01	16.4	299	315	21	36	39.6	118	87	2 32.8	60
20	05	00.0	1.027	64	168	20	06	17.8	299	310	21	41	54.3	118	82	2 35.6	61
20	10	00.0	1.027	65	174	20	11	18.9	299	304	21	46	59.0	118	76	2 37.8	61
20	15	00.0	1.028	66	181	20	16	19.8	299	298	21	51	54.0	118	72	2 39.6	62
20	20	00.0	1.028	67	188	20	21	20.4	299	291	21	56	39.7	117	67	2 40.8	63
20	25	00.0	1.028	67	195	20	26	20.8	299	284	22	01	16.4	117	63	2 41.6	63
20	30	00.0	1.028	67	202	20	31	20.9	299	276	22	05	44.5	116	60	2 41.8	63
20	35	00.0	1.028	67	209	20	36	20.8	298	269	22	10	04.4	116	56	2 41.6	63
20	40	00.0	1.028	66	215	20	41	20.5	298	262	22	14	16.3	115	53	2 41.0	63
20	45	00.0	1.028	65	221	20	46	19.8	297	256	22	18	20.3	115	50	2 39.6	63
20	50	00.0	1.027	64	227	20	51	18.9	297	250	22	22	17.1	114	47	2 37.8	63
20	55	00.0	1.027	62	232	20	56	17.7	296	245	22	26	06.7	114	45	2 35.4	63
21	00	00.0	1.027	60	236	21	01	16.3	296	240	22	29	49.3	113	42	2 32.6	63
21	05	00.0	1.027	58	240	21	06	14.6	295	235	22	33	25.1	112	40	2 29.2	63
21	10	00.0	1.026	56	243	21	11	12.6	294	231	22	36	54.2	112	38	2 25.2	62
21	15	00.0	1.026	54	246	21	16	10.4	294	227	22	40	16.7	111	35	2 20.8	61
21	20	00.0	1.025	51	249	21	21	07.9	293	224	22	43	32.4	111	33	2 15.8	59
21	25	00.0	1.025	48	251	21	26	05.0	292	221	22	46	41.3	110	31	2 10.0	59
21	30	00.0	1.024	45	253	21	31	02.0	292	218	22	49	42.9	109	30	2 04.0	57
21	35	00.0	1.024	42	255	21	35	58.6	291	215	22	52	36.6	108	28	1 57.2	55
21	40	00.0	1.023	38	256	21	40	54.9	290	212	22	55	21.4	108	26	1 49.8	53
21	45	00.0	1.022	34	258	21	45	50.8	289	210	22	57	55.3	107	24	1 41.6	51
21	50	00.0	1.021	29	259	21	50	46.3	288	207	23	00	15.1	106	23	1 32.6	48
21	52	00.0	1.020	27	259	21	52	44.3	287	206	23	01	05.8	106	22	1 28.6	46
21	54	00.0	1.019	25	259	21	54	42.1	287	205	23	01	52.4	106	21	1 24.2	45
21	56	00.0	1.019	23	260	21	56	39.8	287	204	23	02	34.0	105	20	1 19.6	44
21	58	00.0	1.018	20	260	21	58	37.4	286	204	23	03	08.7	105	20	1 14.8	41
22	00	00.0	1.017	17	261	22	00	34.6	286	203	23	03	33.4	104	19	1 09.2	39
22	01	00.0	1.017	15	261	22	01	33.0	285	202	..	..	.. .	...	...	1 06.0	38
22	02	00.0	1.016	13	261	22	02	31.3	285	202	..	..	.. .	...	...	1 02.6	36
22	03	00.0	1.015	10	261	22	03	29.3	285	201	..	..	.. .	...	...	0 58.6	35
22	04	00.0	1.014	7	262	22	04	26.7	284	200	..	..	.. .	...	...	0 53.4	32

LOCAL CIRCUMSTANCES

Geographic Locations in South America	Latitude	Longitude	First Contact Universal Time	First Contact P	First Contact V	Second Contact Universal Time	Second Contact P	Second Contact V
	° ′	° ′	h m s	°	°	h m s	°	°
Ambalema, Colombia, *HIMAT*	+ 4 48.0	+ 74 48.0	20 54 38.6	286	205	22 02 52.9	129	45
Anolaima, Colombia, *HIMAT*	+ 4 46.0	+ 74 26.0	20 55 06.4	286	205	22 03 09.8	145	61
Arme, Colombia	+ 4 58.0	+ 74 55.0	20 54 22.4	286	205	22 02 41.7	87	4
Armenia, Colombia	+ 4 32.0	+ 75 42.0	20 53 50.1	286	206			
Barinas, Venezuela	+ 8 38.0	+ 70 13.0	20 56 26.9	280	202			
Barquisimeto, Venezuela	+10 05.0	+ 69 20.0	20 56 16.6	277	201			
Bogota, Colombia, *National Obsy.*	+ 4 35.9	+ 74 04.9	20 55 38.4	286	205			
Bogota, Colombia, *HIMAT*	+ 4 38.0	+ 74 06.0	20 55 35.4	286	205			
Bucaramanga, Colombia	+ 7 08.0	+ 73 10.0	20 54 37.3	282	203			
Buga, Colombia	+ 3 55.0	+ 76 18.0	20 53 37.8	288	206			
Cali, Colombia	+ 3 25.0	+ 76 30.0	20 53 49.1	288	207			
Caracas, Venezuela, *Cagigal Obsy.*	+10 30.4	+ 66 55.7	20 57 55.7	277	200			
Cartagena, Venezuela	+10 24.0	+ 75 33.0	20 49 38.9	277	203			
Cartago, Colombia	+ 4 45.0	+ 75 55.0	20 53 24.3	286	206	22 02 22.9	117	34
Cucuta, Colombia	+ 7 54.0	+ 72 31.0	20 54 44.8	281	203			
Facatativa, Colombia	+ 4 48.0	+ 74 22.0	20 55 09.7	286	205	22 03 08.3	137	53
Gacheta, Colombia, *HIMAT*	+ 4 50.0	+ 73 38.0	20 55 55.1	286	205	22 03 27.7	148	64
Girardot, Colombia	+ 4 17.0	+ 74 48.0	20 55 03.7	287	206			
Guanare, Venezuela	+ 9 01.0	+ 69 45.0	20 56 36.2	279	202			
Guayaquil, Ecuador	− 2 13.0	+ 79 54.0	20 55 02.3	299	211			
Ibague, Colombia	+ 4 26.0	+ 75 14.0	20 54 27.4	287	206			
La Paz, Bolivia	−16 30.0	+ 68 10.0	21 26 05.6	328	223			
La Union, Colombia, *HIMAT*	+ 4 32.0	+ 76 03.0	20 53 24.8	287	206			
Lima, Peru	−12 06.0	+ 77 03.0	21 11 29.0	317	218			
Manizales, Colombia	+ 5 04.5	+ 75 32.0	20 53 36.2	286	205	22 02 40.3	34	311
Manizales, Colombia, *HIMAT*	+ 5 02.0	+ 75 28.0	20 53 42.8	286	205	22 02 34.3	55	332
Maracaibo, Venezuela	+10 44.0	+ 71 37.0	20 53 45.1	276	201			
Medellin, Colombia	+ 6 15.0	+ 75 35.0	20 52 36.4	284	205			
Merida, Venezuela	+ 8 38.0	+ 71 05.0	20 55 41.1	280	202			
Mosquera, Colombia, *HIMAT*	+ 4 41.0	+ 74 12.0	20 55 26.5	286	205			
Pereira, Colombia, *HIMAT*	+ 4 52.0	+ 75 54.0	20 53 19.2	286	206	22 02 18.1	92	8
Pereira, Colombia, *HIMAT*	+ 4 47.0	+ 75 44.0	20 53 35.6	286	206	22 02 26.3	113	30
Pereira, Colombia	+ 4 49.0	+ 75 42.0	20 53 36.2	286	206	22 02 25.6	106	23
Puerto Abadia, Colombia	+ 4 39.0	+ 75 35.0	20 53 51.3	286	206	22 02 43.9	152	68
Puerto Ayacucho, Venezuela	+ 5 39.0	+ 67 37.0	21 00 42.7	285	203	22 04 28.3	108	24
Quito, Ecuador	− 0 14.0	+ 78 29.6	20 54 48.0	295	209			
San Cristobal, Venezuela	+ 7 46.0	+ 72 15.0	20 55 06.6	281	203			
San Pablo, Colombia	+ 5 27.0	+ 70 57.0	20 58 04.3	285	204	22 03 58.0	56	332
Santuario, Colombia, *HIMAT*	+ 5 05.0	+ 75 58.0	20 53 04.8	286	205			
Sogamoso, Colombia	+ 5 43.0	+ 72 57.0	20 55 57.2	284	204			
Sutatenza, Colombia, *HIMAT*	+ 5 02.0	+ 73 28.0	20 55 56.3	286	205	22 03 16.2	101	17
Trinidad, Colombia	+ 5 24.0	+ 71 41.0	20 57 25.3	285	204	22 03 50.6	45	322
Valencia, Venezuela	+10 10.0	+ 68 00.0	20 57 18.5	277	200			
Villavicencio, Colombia	+ 4 10.0	+ 73 38.0	20 56 26.2	287	205			
Zipaquira, Colombia	+ 5 01.0	+ 74 00.0	20 55 23.7	286	205	22 03 05.4	92	9

LOCAL CIRCUMSTANCES

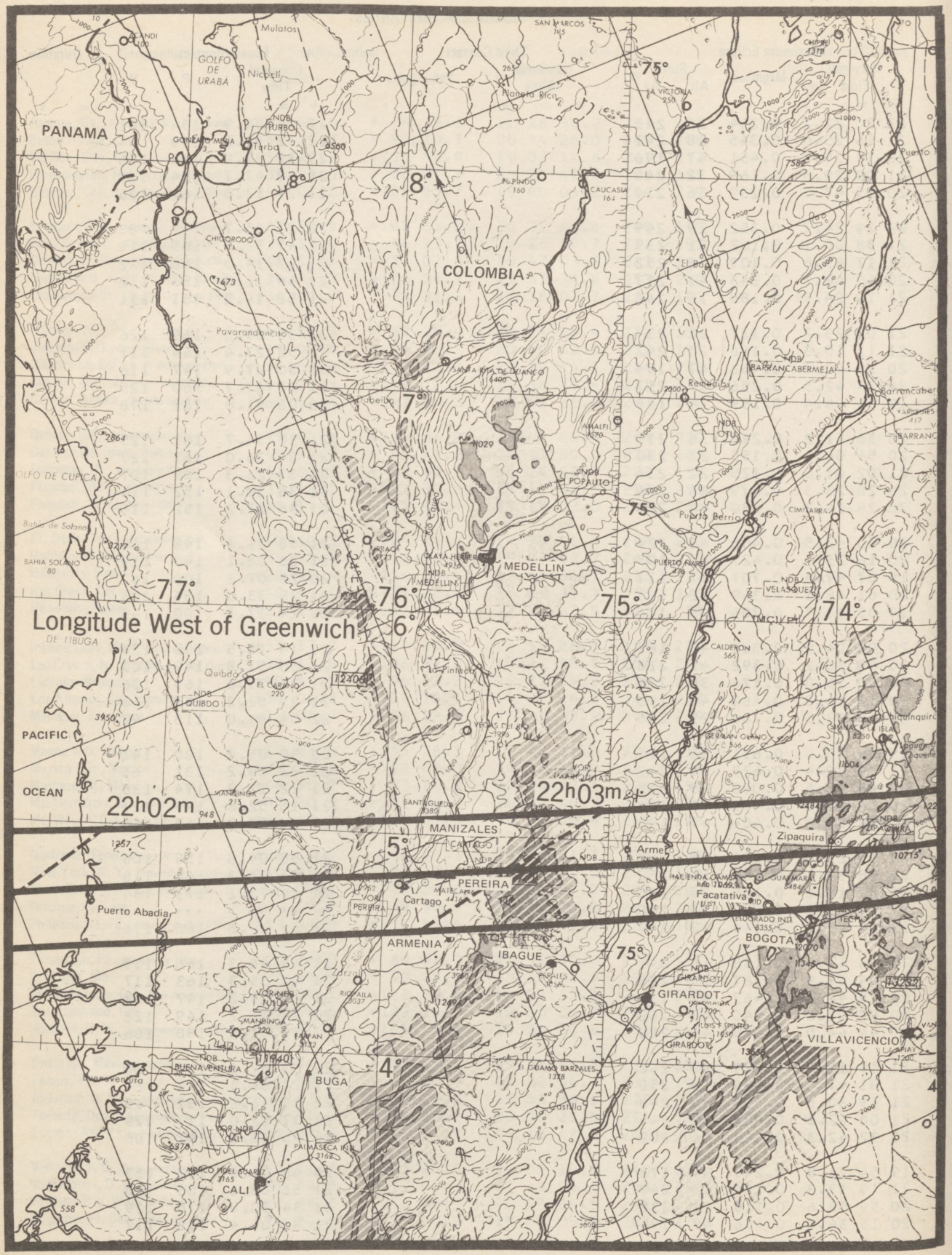
Maximum Eclipse				Third Contact			Fourth Contact			Duration	Width of Path
Universal Time	Magnitude	Sun's Alt.	Sun's Az.	Universal Time	P	V	Universal Time	P	V		
h m s		°	°	h m s	°	°	h m s	°	°	m s	mi
22 03 19.1	1.015	10	261	22 03 45.4	260	177	.. ..	...	...	0 52.5	34
22 03 31.3	1.015	9	261	22 03 52.8	244	160	.. ..	...	...	0 43.0	34
22 03 09.2	1.015	10	261	22 03 36.8	302	218	.. ..	...	...	0 55.1	35
22 03 06.4	0.998	11	261				.. ..	...	...		
22 02 13.7	0.909	5	261				.. ..	...	...		
22 01 21.3	0.869	4	262				.. ..	...	...		
22 03 47.2	0.996	9	262				.. ..	...	...		
22 03 45.4	0.997	9	262				.. ..	...	...		
22 02 20.9	0.945	8	261				.. ..	...	...		
22 03 13.3	0.981	11	261				.. ..	...	...		
22 03 26.8	0.967	12	261				.. ..	...	...		
22 01 33.6	0.865	2	262				.. ..	...	...		
21 58 38.4	0.843	11	260				.. ..	...	...		
22 02 51.8	1.015	11	261	22 03 20.8	272	188	.. ..	...	...	0 57.9	35
22 02 01.6	0.924	7	261				.. ..	...	...		
22 03 32.2	1.015	9	261	22 03 56.0	252	168	.. ..	...	...	0 47.7	34
22 03 47.6	1.015	9	262	22 04 07.6	240	156	.. ..	...	...	0 39.9	33
22 03 39.4	0.988	10	261				.. ..	...	...		
22 02 03.8	0.899	5	262				.. ..	...	...		
22 04 44.3	0.801	15	263				23 05 42.1	92	0		
22 03 22.8	0.994	10	261				.. ..	...	...		
22 10 37.4	0.312	4	263				.. ..	...	...		
22 02 56.1	0.999	11	261				.. ..	...	...		
22 08 51.9	0.481	13	265				23 00 30.2	72	330		
22 02 50.0	1.015	11	261	22 02 59.8	355	272	.. ..	...	...	0 19.5	35
22 02 53.5	1.015	11	261	22 03 12.6	334	250	.. ..	...	...	0 38.3	35
22 00 06.0	0.844	7	261				.. ..	...	...		
22 01 58.2	0.965	11	261				.. ..	...	...		
22 01 59.9	0.906	6	261				.. ..	...	...		
22 03 41.0	0.999	9	261				.. ..	...	...		
22 02 47.0	1.015	11	261	22 03 16.0	298	214	.. ..	...	...	0 57.9	35
22 02 55.5	1.015	11	261	22 03 24.7	276	192	.. ..	...	...	0 58.4	35
22 02 55.1	1.015	11	261	22 03 24.6	283	199	.. ..	...	...	0 59.0	35
22 03 03.7	1.015	11	261	22 03 23.6	237	153	.. ..	...	...	0 39.7	35
22 04 51.1	1.013	2	262	22 05 13.9	279	195	.. ..	...	...	0 45.6	29
22 04 34.9	0.860	14	262				.. ..	...	...		
22 02 13.4	0.928	7	261				.. ..	...	...		
22 04 15.0	1.014	6	262	22 04 32.0	332	248	.. ..	...	...	0 34.0	32
22 02 37.2	0.999	11	261				.. ..	...	...		
22 03 28.3	0.987	8	261				.. ..	...	...		
22 03 43.7	1.015	8	262	22 04 11.2	288	204	.. ..	...	...	0 55.0	33
22 04 04.2	1.014	6	262	22 04 17.8	343	259	.. ..	...	...	0 27.2	32
22 01 35.9	0.871	3	262				.. ..	...	...		
22 04 12.2	0.982	9	262				.. ..	...	...		
22 03 32.8	1.015	9	261	22 04 00.1	296	213	.. ..	...	...	0 54.7	34

LOCAL CIRCUMSTANCES

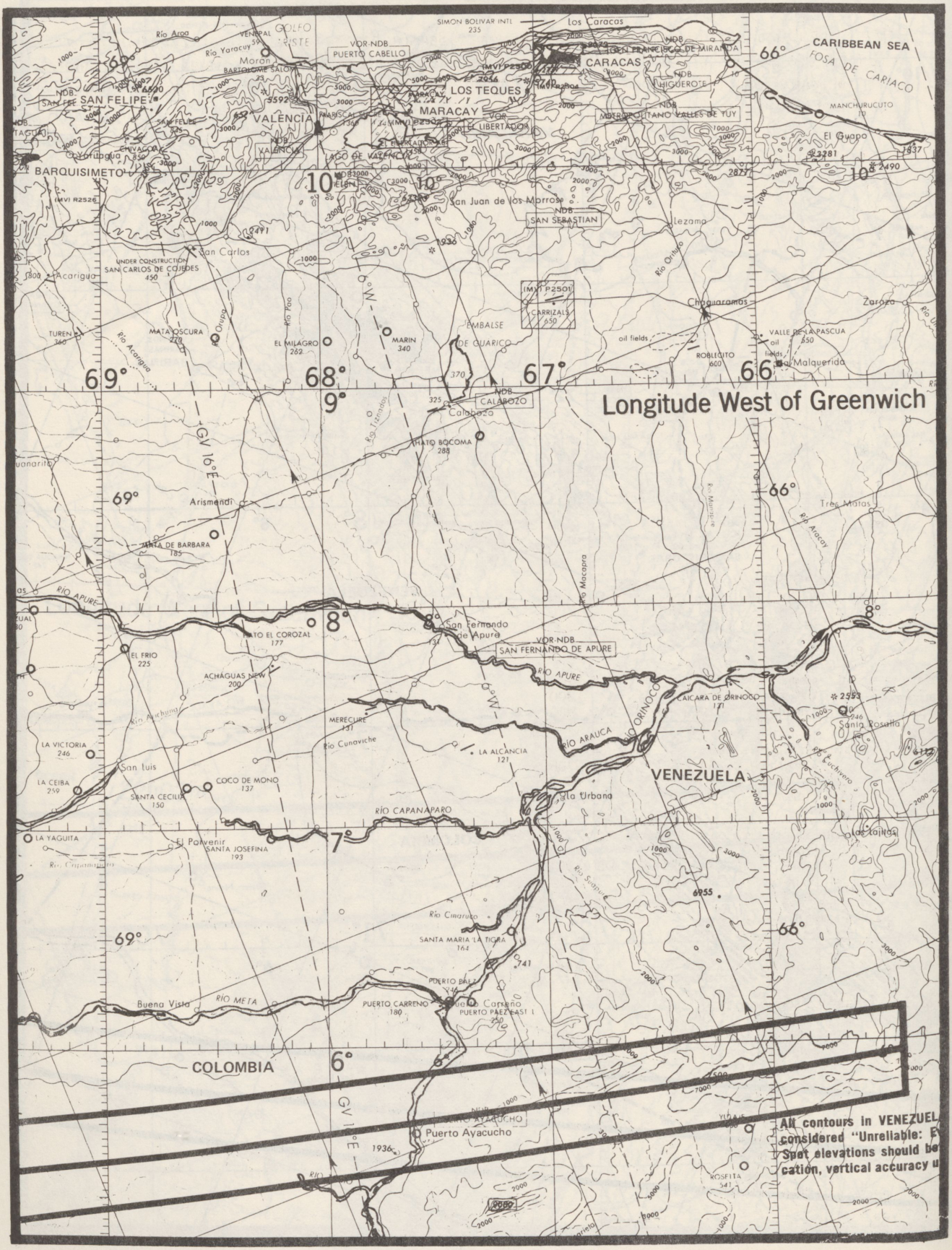
Geographic Locations not in South America	Latitude	Longitude	First Contact Universal Time	P	V	Second Contact Universal Time	P	V
	° ′	° ′	h m s	°	°	h m s	°	°
Atlanta, Ga., *Fernbank Science Center*	+33 46.6	+ 84 19.1	20 28 38.2	241	197			
Baton Rouge, La.	+30 24.7	+ 91 10.7	20 14 26.0	249	209			
Big Bear City, Cal., *Solar Obsy.*	+34 15.2	+116 54.8	19 02 14.8	263	272			
Bloomington, Ind., *Kirkwood Obsy.*	+39 09.9	+ 86 31.3	20 25 47.7	233	195			
Boulder, Col., *Sommers-Bausch Obsy.*	+40 00.2	+105 15.7	19 40 06.2	244	230			
Bronson, Fla., *Rosemary Hill Obsy.*	+29 23.9	+ 82 35.2	20 31 41.6	248	198			
Brooklyn, Ind., *Goethe Link Obsy.*	+39 33.0	+ 86 23.7	20 26 10.7	232	195			
Cambridge, Mass., *Harvard Coll. Obsy.*	+42 22.8	+ 71 07.8	20 47 03.8	223	180			
Capilla Peak, N. M., *U. N. M. Obsy.*	+34 41.8	+106 24.3	19 33 37.8	253	240			
Charlottesville, Va., *McCormick Obsy.*	+38 02.0	+ 78 31.3	20 38 07.7	232	189			
Chicago, Ill.	+41 52.5	+ 87 38.4	20 24 56.4	228	194			
Cincinnati, O., *Observatory*	+39 08.3	+ 84 25.3	20 29 32.9	232	193			
Claremont, Cal., *F. P. Brackett Obsy.*	+34 05.6	+117 42.7	18 59 54.5	264	275			
Climax, Col., *High Altitude Obsy.*	+39 23.5	+106 12.6	19 36 57.4	245	234			
College, Alaska, *Geophysical Inst.*	+64 52.4	+147 50.0	18 55 21.4	233	250			
Denver, Col., *Chamberlin Obsy.*	+39 40.6	+104 56.9	19 40 46.4	244	230			
Des Moines, Iowa, *Drake U.*	+41 35.7	+ 93 41.2	20 11 50.0	232	204			
Evanston, Ill., *Dearborn Obsy.*	+42 03.5	+ 87 40.5	20 24 58.7	228	194			
Flagstaff, Ariz., *Lowell Obsy.*	+35 12.1	+111 39.8	19 18 06.3	257	255			
Flagstaff, Ariz., *Naval Obsy.*	+35 11.0	+111 44.4	19 17 52.0	257	255			
Ft. Davis, Tex., *McDonald Obsy.*	+30 40.3	+104 31.3	19 38 01.4	258	240			
Goldstone, Cal., *Jet Prop. Lab.*	+35 23.6	+116 50.9	19 03 08.7	261	270			
Haleakala, Hawaii	+20 42.4	+156 15.4	17 56 56.1	313	17			
Hat Creek, Cal.	+40 49.1	+121 28.4	18 55 31.7	256	270			
Honolulu, Hawaii	+21 18.4	+157 51.6	17 55 37.9	312	17			
Incline Lake, Nev., *MacLean Obsy.*	+39 17.7	+119 55.7	18 57 56.8	257	270			
Las Cruces, N. M., *Tortugas Mt. Obsy.*	+32 17.6	+106 41.8	19 31 48.8	257	244			
Lincoln, Nebraska	+40 49.0	+ 96 42.2	20 03 59.5	236	210			
Los Angeles, Cal., *Griffith Obsy.*	+34 06.8	+118 18.1	18 58 16.6	264	277			
Managua, Nicaragua	+12 06.0	+ 86 18.0	20 31 35.4	276	209			
Mauna Kea, Hawaii	+19 49.6	+155 28.3	17 58 11.0	314	19			
Mexico City, Mexico	+19 25.8	+ 99 07.0	19 55 56.9	271	231			
Minneapolis, Minn.	+44 58.7	+ 93 14.3	20 15 22.1	226	199			
Mt. Hamilton, Cal., *Lick Obsy.*	+37 20.4	+121 38.7	18 51 40.7	262	279			
Mt. Wilson, Cal., *Hale Obsy.*	+34 13.0	+118 03.6	18 59 00.4	264	276			
Nashville, Tenn., *Dyer Obsy.*	+36 03.1	+ 86 48.3	20 24 21.7	238	198			
New York, N. Y., *Columbia U. Obsy.*	+40 48.6	+ 73 57.5	20 44 01.5	227	183			
Northfield, Minn., *Goodsell Obsy.*	+44 27.7	+ 93 09.0	20 15 07.7	227	199			
Panama, Panama	+ 8 57.0	+ 79 30.0	20 45 23.1	280	205			
Philadelphia, Pa., *Flower & Cook Obsy.*	+39 59.9	+ 75 28.6	20 42 13.9	228	185			
Pittsburgh, Pa., *Allegheny Obsy.*	+40 29.0	+ 80 01.3	20 36 50.8	228	187			
St. Louis, Mo.	+38 38.9	+ 90 18.3	20 17 58.7	235	201			
San Fernando, Cal., *Van Norman Obsy.*	+34 18.5	+118 29.5	18 57 52.1	264	277			
San Francisco, Cal.	+37 46.6	+122 24.7	18 50 06.7	262	279			
Sunspot, N. M., *Sacramento Peak Obsy.*	+32 47.2	+105 49.2	19 34 38.8	255	241			
Tacubaya, Mexico, *National Obsy.*	+19 24.3	+ 99 11.7	19 55 44.1	271	231			
Tampa, Fla.	+27 57.0	+ 82 27.4	20 32 06.1	250	199			
Tonanzintla, Mex., *Nat. Astrophys. Obsy.*	+19 02.0	+ 99 18.8	19 55 34.6	272	231			
Toronto, Ont., *Meteorological Obsy.*	+43 40.0	+ 79 23.9	20 39 21.0	222	183			
Tucson, Ariz., *Kitt Peak Nat. Obsy.*	+31 57.5	+111 35.7	19 16 47.3	262	260			
Victoria, B. C., *Dom. Astrophys. Obsy.*	+48 31.3	+123 25.0	19 01 10.6	245	257			
Washington, D. C., *Naval Obsy.*	+38 55.2	+ 77 03.9	20 40 08.4	230	187			
Williams Bay, Wisc., *Yerkes Obsy.*	+42 34.2	+ 88 33.4	20 23 34.5	228	195			
Wrightwood, Cal., *Table Mt. Obsy.*	+34 22.9	+117 40.9	19 00 09.7	263	274			

LOCAL CIRCUMSTANCES

Maximum Eclipse			Sun's		Third Contact			Fourth Contact			Duration	Width of Path
Universal Time	Magnitude		Alt.	Az.	Universal Time	P	V	Universal Time	P	V		
h m s			°	°	h m s	°	°	h m s	°	°	m s	mi
21 20 22.2	0.264		20	245				22 08 04.9	154	101		
21 16 25.0	0.345		28	241				22 12 46.2	149	94		
20 17 29.3	0.451		47	196				21 31 31.9	148	116		
21 08 29.8	0.169		22	240				21 48 47.7	164	118		
20 35 47.5	0.239		36	214				21 29 13.6	161	126		
21 29 24.7	0.352		19	249				22 21 45.7	147	88		
21 08 00.1	0.162		21	239				21 47 32.2	165	119		
21 17 45.8	0.109		8	252				21 47 14.0	168	122		
20 40 43.1	0.343		41	217				21 44 11.9	153	112		
21 19 24.8	0.180		15	248				21 58 14.8	161	111		
21 02 23.2	0.127		22	237				21 38 09.0	169	126		
21 11 10.3	0.166		20	242				21 50 27.4	164	117		
20 15 49.7	0.463		47	194				21 30 47.9	147	116		
20 34 42.5	0.256		37	213				21 30 07.7	160	125		
19 31 46.4	0.159		14	148				20 08 51.0	168	178		
20 36 51.2	0.242		36	215				21 30 34.7	161	125		
20 54 06.2	0.150		27	230				21 34 26.0	167	127		
21 02 01.6	0.125		22	236				21 37 26.3	169	127		
20 28 23.3	0.379		44	206				21 36 10.1	152	116		
20 28 14.3	0.380		44	206				21 36 07.2	152	116		
20 50 43.5	0.408		41	224				21 58 11.4	148	100		
20 16 25.6	0.427		46	195				21 28 38.1	149	119		
19 07 47.5	0.707		37	117				20 28 07.3	100	142		
20 01 48.1	0.369		42	183				21 08 33.5	154	135		
19 05 18.7	0.706		35	116				20 24 17.8	100	143		
20 06 04.9	0.382		43	187				21 14 18.5	153	131		
20 43 30.2	0.392		42	218				21 50 51.8	149	105		
20 50 25.0	0.176		30	226				21 34 37.6	165	126		
20 14 26.8	0.469		48	193				21 29 52.2	147	116		
21 48 22.5	0.786		23	256				22 54 44.0	118	42		
19 09 23.0	0.691		38	117				20 30 05.9	100	141		
21 19 19.4	0.628		39	242				22 32 39.2	131	66		
20 49 20.5	0.098		25	228				21 22 12.2	174	138		
20 04 00.6	0.440		45	184				21 16 52.8	149	127		
20 14 53.2	0.464		47	193				21 29 57.0	147	116		
21 13 25.0	0.224		23	241				21 59 04.8	158	108		
21 18 30.1	0.133		11	250				21 51 21.3	166	118		
20 50 18.0	0.105		25	228				21 24 15.1	173	136		
21 57 29.8	0.878		15	260				•• •• •• •	•••	•••		
21 18 42.7	0.146		12	249				21 53 20.6	165	116		
21 13 42.4	0.138		16	245				21 48 44.3	166	119		
21 04 07.9	0.187		25	236				21 47 35.3	163	117		
20 13 48.5	0.467		47	192				21 29 05.2	147	117		
20 02 02.8	0.440		45	182				21 14 45.2	149	128		
20 44 44.0	0.375		41	219				21 50 31.1	150	106		
21 19 12.4	0.629		39	242				22 32 37.6	131	66		
21 31 47.0	0.384		19	250				22 25 38.1	144	84		
21 19 30.8	0.639		39	243				22 33 16.6	131	65		
21 08 42.6	0.088		15	244				21 37 02.0	173	129		
20 32 42.3	0.443		46	209				21 45 18.2	147	106		
19 54 21.8	0.249		34	178				20 48 06.6	162	153		
21 19 13.3	0.164		13	249				21 56 08.1	163	113		
20 59 58.6	0.119		22	235				21 34 50.8	170	129		
20 15 34.9	0.456		47	194				21 30 04.4	148	117		


PANAMA
COLOMBIA
PACIFIC
OCEAN
Longitude West of Greenwich
77°
76°
75°
74°
8°
7°
6°
5°
4°
22h02m
22h03m
MEDELLIN
MANIZALES
PEREIRA
ARMENIA
IBAGUE
BOGOTA
CALI
BUGA
GIRARDOT
VILLAVICENCIO
Puerto Abadia
Cartago
Facatativa
Zipaquira
Armero
Mulatos
Turbo
Quibdo
Buenaventura
Barrancabermeja
Puerto Berrio
POPAYAN

LAKE
MARACAIBO
VENEZUELA
COLOMBIA
MERIDA
BARINAS
GUANARE
SAN CRISTOBAL
CUCUTA
BUCARAMANGA
Arauca
Trinidad
San Pablo
SOGAMOSO
SIERRA NEVADA DE COCUY
22h04m
Río Apure
Río Arauca
Río Meta
Río Catatumbo
Río Escalante
Río Sarare
Río Ele
Río Tomo
Río Dorados
Río Arichuna
Río Aricagua
Caño Cucuy
Santa Barbara
Palo Gordo
Quebrada Arriba
Chiriguana
Curumani
Tucaco
Tucacas
Valera
Trujillo
Barinas Civil
Guanare
Acarigua
Barquisimeto
Palmarito
Guasdualito
Santiago Perez
El Fuentero
El Tigre
Cravo Norte
Pondon
Raz de Ariporo
Guayabal
Villanueva
Hacienda
Tarlon de Tamara
Pore
Maferro
San Pedro
Mare Mare
Cocuy
Aguas Claras
Macaritana
Moscuta
Cucuta
Camilo Daza
San Antonio del Tachira
Santa Barbara Centro
Ureña
Santo Domingo
Tamiopa
Bucaramanga
Palenque
Guaca
Giron
Malaga
Capitanejo
Saravena
Tame
Arauca
Ojo de Agua
Muchachachi
Ciudad Bolivia
Suripa
Turagua
Sabaneta de Palmarito
Mene Grande
Bachaquero
Tomoporo
Lagunillas
oil fields
Motatan
Escuque
Boconoito
Betijoque
Carvajal
Sonora
Parapara
Rosario
El Castillo
Venezuela
Colombia
Pedregal
Tibu
Orope
La Fria
La Fria New
La Estrella
Pelotera
La Aloma
Agua Roja
Aguas Claras
Mare Mare
Maferro
Pore
Tame
Arauca
Trujillo
Valera
Barinas
Guanare
Acarigua
Barquisimeto
Palmarito
Guasdualito
Santiago Perez
El Fuentero
El Tigre
Cravo Norte
Pondon
Raz de Ariporo
Guayabal
Villanueva
Hacienda
Tarlon de Tamara
Trinidad
San Pablo
Maferro
San Pedro
Mare Mare
Cocuy
Ojo de Agua
Muchachachi
Ciudad Bolivia
Suripa
Turagua
Sabaneta de Palmarito
Mene Grande
Bachaquero
Tomoporo
Lagunillas
oil fields
Motatan
Escuque
Boconoito
Betijoque
Carvajal
Sonora
Parapara
Rosario
El Castillo
Venezuela
Colombia
Pedregal
Tibu
Orope
La Fria
La Fria New
La Estrella
Pelotera
La Aloma
Agua Roja
Aguas Claras
Macaritana
Moscuta
Cucuta
Camilo Daza
San Antonio del Tachira
Santa Barbara Centro
Ureña
Santo Domingo
Tamiopa
Bucaramanga
Palenque
Guaca
Giron
Malaga
Capitanejo
Saravena
Tame
Arauca


Longitude West of Greenwich
CARIBBEAN SEA
FOSA DE CARIACO
VENEZUELA
COLOMBIA
CARACAS
LOS TEQUES
MARACAY
VALENCIA
BARQUISIMETO
SAN FELIPE
Río Aroa
Río Yaracuy
Moron
GOLFO TRISTE
PUERTO CABELLO
SIMON BOLIVAR INTL
Los Caracas
SAN FRANCISCO DE MIRANDA
HIGUEROTE
MANCHURUCUTO
El Guapo
LAGO DE VALENCIA
San Juan de los Morros
SAN SEBASTIAN
Lezama
Chaguaramos
Zaraza
CARRIZALES
EMBALSE DE GUARICO
oil fields
VALLE DE LA PASCUA
Malaquerida
ROBLECITO
San Carlos
UNDER CONSTRUCTION SAN CARLOS DE COJEDES
Acarigua
TUREN
MATA OSCURA
EL MILAGRO
MARIN
Río Acarigua
Río Portuguesa
Río Pao
Río Orituco
Río Tamanaco
Río Manapire
Río Macapro
Río Aragay
Río Cunaviche
Río Cinaruco
Río Capanaparo
Río Suapure
Río Meta
Río Arauca
Río Orinoco
Río Apure
Río Cuchivero
Río Caroní
Río Caura
Río Paragua
Río Yuruari
Río Aro
Río Caparo
Río Guanarito
Río Portuguesa
Río Acarigua
Río Cojedes
Río Tinaco
Río Guarico
Río Unare
Río Neverí
Río Guanipa
Río Morichal Largo
Río Tigre
Río Amana
Río Guarapiche
Río Caris
Río Aguasay
Río Guarapiche
Río Caris
Río Aguasay
Río Guarapiche
Río Caris
Río Aguasay

CLIMATOLOGICAL DATA FOR COLOMBIA

HIMAT, the Colombian Hydrological and Meteorological Service, has the following records on cloud cover in October at stations in or near the path of this eclipse. The units are eighths of sky covered. The times are local time, the standard time zone is 5 hours west (add 5 hours to obtain UT). The stations are here listed west to east along the path.

		Local Time	1970	1971	1972	1973	1974
La Union, Valle							
Longitude	+76° 03′	0700	6.7	6.3	4.8	7.2	
Latitude	+ 4° 32′	1300	4.6	3.4	4.0	5.7	
Elevation	913m.	1900	5.5	5.4	5.5	5.6	
		Monthly Mean	5.6	5.0	4.8	6.2	
Santuario, Risaralda							
Longitude	+75° 58′	0700			4.3	6.4	
Latitude	+ 5° 05′	1300			5.3	6.4	
Elevation	1963 m.	1900			4.2	5.5	
		Monthly Mean			4.6	6.1	
Pereira, Risaralda							
Longitude	+75° 54′	0700	7.3	7.5	6.0		
Latitude	+ 4° 52′	1300	6.4	6.8	5.2		
Elevation	1020 m.	1900	7.6	7.4	4.9		
		Monthly Mean	7.1	7.2	5.4		
Pereira, Risaralda (Matecana Airport)							
Longitude	+75° 44′	0700	7.0	7.0	6.2	7.3	7.2
Latitude	+ 4° 47′	1300	6.4	6.3	6.7	6.8	6.9
Elevation	1342 m.	1900	6.6	6.5	6.3	6.6	6.9
		Monthly Mean	6.7	6.7	6.4	6.9	7.0
Manizales, Caldas (La Nubia Airport)							
Longitude	+75° 28′	0700	6.5	6.8	6.7	7.0	5.3
Latitude	+ 5° 02′	1300	6.7	7.5	7.5	7.8	7.5
Elevation	2012 m.	1900	6.7	6.6	7.3	6.7	6.3
		Monthly Mean	6.6	7.0	7.2	7.2	6.3
Ambalema, Tolima							
Longitude	+74° 48′	0700	6.4	7.0	7.1		
Latitude	+ 4° 48′	1300	4.4	4.0	4.5		
Elevation	450 m.	1900	4.4	6.8	7.3		
		Monthly Mean	5.1	5.9	6.3		
Anolaima, Cundinamarca							
Longitude	+74° 26′	0700		5.1	5.2	5.0	
Latitude	+ 4° 46′	1300		5.5	5.4	5.2	
Elevation	1943 m.	1900		4.5	5.2	5.3	
		Monthly Mean		5.1	5.3	5.2	
Mosquera, Cundinamarca							
Longitude	+74° 12′	0700		7.4	5.8	6.8	6.5
Latitude	+ 4° 41′	1300		7.2	6.9	6.9	6.8
Elevation	2547 m.	1900		7.9	6.8	5.7	4.5
		Monthly Mean		7.5	6.5	6.5	7.3
Bogota, Cundinamarca (National Meteorological Observatory)							
Longitude	+74° 06′	0700	7.8	6.8	5.9	6.7	6.4
Latitude	+ 4° 38′	1300	7.3	7.0	6.1	7.1	7.1
Elevation	2556 m.	1900	7.4	4.7	4.2	6.5	6.1
		Monthly Mean	7.4	6.2	5.4	6.8	6.5
Gacheta, Cundinamarca							
Longitude	+73° 38′	0700			6.4	7.8	5.4
Latitude	+ 4° 50′	1300			4.4	6.4	4.9
Elevation	1780 m.	1900			5.4	6.8	5.5
		Monthly Mean			5.4	7.0	5.3
Sutatenza, Boyaca							
Longitude	+73° 28′	0700	6.8	6.6	5.1		
Latitude	+ 5° 02′	1300	5.9	5.3	4.1		
Elevation	1930 m.	1900	5.8	5.0	5.1		
		Monthly Mean	6.2	5.6	4.8		